

The AMSAT[®] Journal

Editor
JoAnne Maenpaa, WB9JEJ
Editorial Staff
John Bubbers, W1GYD
Bill Hook, W3QBC
Haley Hintze

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CONTENTS

Apogee View 3
by Robin Haighton, VE3FRH

Space Symposium Final Call for Papers 4

AMSAT-NA Toronto Annual Meeting and Space Symposium 5

Space Symposium Registration Form 6

Remembering Gerald Schmitt, KK5YY - Silent Key 7

Satellite DX 9
by Wayne Estes, W9AE

AMSAT Jewelry Contest Revived 10
by David Guimont, WB6LLO

AMSAT OSCAR-E, Summer 2003 Status Report 11
by Richard Hamby, W2GPS

Autodesk Case Study: Radio Amateur Satellite Corporation 15
*by DLT Solutions;
Discusses Eagle Thermal and Mechanical Design*

AMSAT Phase 3 - EXPRESS 19
*by Frank Sperber, DB6BN
Translation by John Bubbers, W1GYD*

Our AMSAT-NA Donors 22
by Mal Preston, NP2L

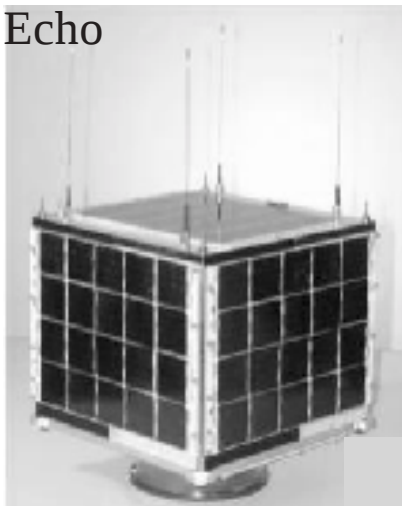
A Small Beam for 70 cm 26
by Lee McLamb, KU4OS

AMSAT at the Dayton Hamvention 2003 28

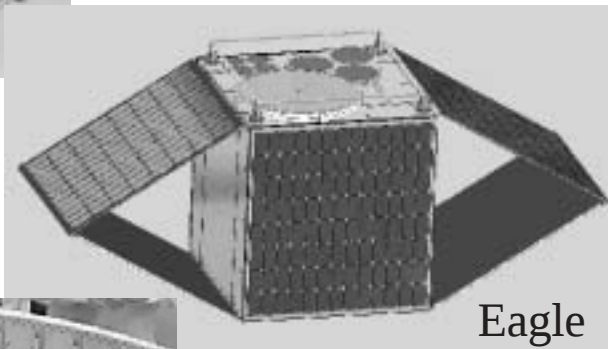
Fly Your Name in Space 30

AMSAT Satellite Demo in Puerto Rico 31
by Angel Santana, WP3GW

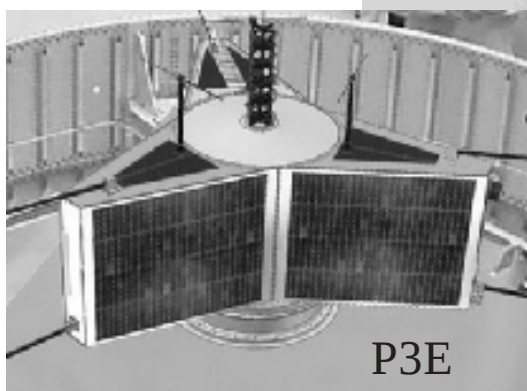
Echo



Getting Ready to Fly!



Eagle



P3E

In this issue:

- Echo
- Eagle
- P3E

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The AMSAT Journal Staff

Editor-in-Chief: JoAnne Maenpaa, WB9JEJ
Associate Editor: Haley Hintze
Circulation: Martha Saragovitz
(martha@amsat.org)
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Editorial Office: JoAnne Maenpaa, WB9JEJ, 608
Hawthorne Lane, Carpentersville, IL, 60110, Internet:
journal@amsat.org, telephone: 847-428-5465. Advertising
Office: AMSAT-NA Headquarters, 850 Sligo Avenue, Suite
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submissions. Whenever possible, submissions should be sent
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processor files; photos or figures in JPEG, GIF, or TIF formats.
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Apogee View

By Robin Haighton, VE3FRH
AMSAT-NA President

AMSAT Membership With Participation

As you will have read in the May/ June
2003 Apogee View, AMSAT is at a
turning point in it's history. Because of an
ambitious satellite building program and a
sudden downturn in the economy our
reserves for building and launching
satellites are at a low point. As it happens,
this coincides with a new opportunity to
develop new thinking by the AMSAT Board
of Directors (BoD), as this year sees the
retirement of two of our long standing
directors and provides the opportunity to
elect some new faces and thoughts.

Retiring from the Board of Directors are Bill
Tynan W3XO, long time director, Past
President and current Board Chairman, and
Dick Daniels W3PUJ a long time director,
builder, satellite experimenter and project
manager of ECHO. While we will miss them
both, I am assured that they will continue to
be active in AMSAT and that their advice
will frequently be sought by the new Board.

Now we have eight members seeking the
four Board positions that become available
this year, plus the two Board Alternate
positions. The Alternates attend the
meetings and can, at the agreement of the
Chair, speak on your behalf. It is therefore
very important that you choose your
representatives with great care. Please read
their resumes and vote for those whose
views match your requirements.

The voting information together with the
Annual Meeting information will be sent to
you in July. We have, in the first time for
many years, a genuine race for the BoD, and
may the best people be successful. In my
opinion all the candidates are all fully
qualified for active Board operation,
although they do represent differing
opinions and constituencies, so the choice
is yours, please use your vote - don't forget
it or loose it.

It is with regret that I have accepted the
resignation of Ray Soifer W2RS as Vice-
President International. Ray has decided to
spend his AMSAT time concentrating on
frequency co-ordination issues and of
course on Straight Key Night. Ray's
"career" with AMSAT has seen him as
member of the Board, Executive Vice-
President (twice) and Vice-President,
International. In addition Ray has been the

"Keeper of the By-Laws" and a great help
to the BoD in many differing ways. Thank
you Ray for your help and assistance over
many years, and thank you for staying
involved with AMSAT.

By now you will know that we are going
ahead with the Annual Meeting and Space
Symposium in Toronto, October 17 and 18. I
am quite confident that the recent problems
will have totally disappeared by that time,
and I look forward to seeing you there and
introducing you to the new Board of
Directors at that time.

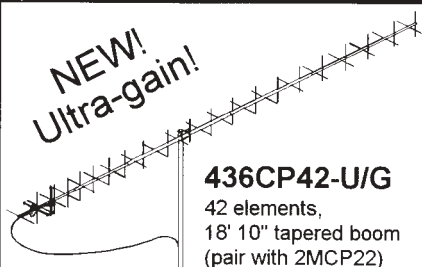
The program is under development, but the
format will be familiar to those of you who
have attended previous sessions. This year
we are developing a special Spouses
Program which involves both a shopping
tour and a trip to one of Toronto's tourist
spots, Casa Loma. On Sunday October 19, a
bus will take all those interested to the
Hammond Radio Museum, one of North
America's finest collections of radios, ham
equipment, and military transceivers from
both World Wars.

By the time you read this column, you will
have received my letter requesting your
financial assistance to AMSAT. In this issue
you will see the listing of those who
generously gave of their resources this past
year, and I sincerely thank them for their
help for without them we could not have
built ECHO and now we are looking at the
launch campaign. To launch this satellite it
will cost us \$150,000 and we need to raise
that amount over the next six months. Yes,
we are booked to launch May 2004, and
every penny we can raise will go toward that
effort, Are you willing to assist? Could you
become a Core Member (or greater) of
AMSAT? Are you going to work the satellite
without participating in it's launch or
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colleagues getting more AMSAT members.
Buy an ECHO golf or tee shirt, together with
an ECHO hat, and let's develop a theme for
the rest of 2003 and 2004. ■

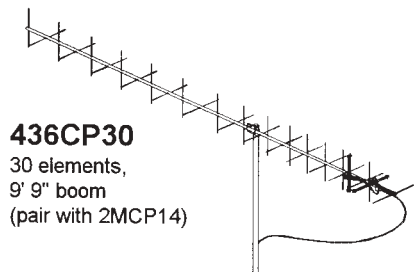
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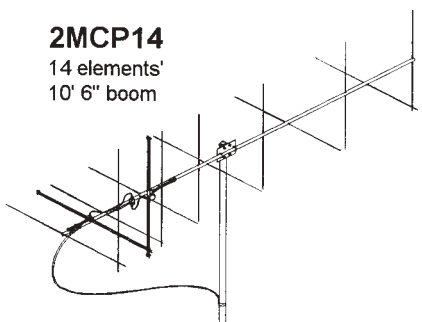
436CP42-U/G

42 elements,
18' 10" tapered boom
(pair with 2MCP22)



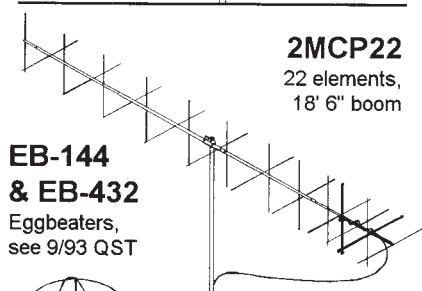
436CP30

30 elements,
9' 9" boom
(pair with 2MCP14)



2MCP14

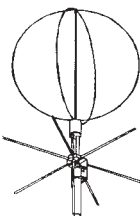
14 elements,
10' 6" boom



2MCP22

22 elements,
18' 6" boom

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Nominations for the AMSAT Board of Directors

The following people have been nominated to serve on the AMSAT Board of Directors:

Barry Baines, WD4ASW
Ken Chaffee, WA1QXR
Steve Diggs, W4EPI
Robin Haighton, VE3FRH
Rick Hambly, W2GPS
Lou McFadin, W5DID
Lee McLamb, KU4OS
Gunther Meisse, W8GSM

Four seats on the seven member board must be filled this year. Those whose terms are expiring are: Barry Baines, WD4ASW, Dick Daniels, W4PUJ, Robin Haighton, VE3FRH and Bill Tynan, W3XO. Dick Daniels and Bill Tynan have decided not to run for re-election. Ballots were mailed by July 15th.

AMSAT-NA Space Symposium Final Call for Papers

The 2003 AMSAT-NA Annual Symposium is scheduled for October 17-19, 2003 in Toronto, Ontario, Canada. This is the first call for papers to be presented at the 2003 Symposium. Papers may be presented by

the author during the Symposium, or simply offered for inclusion in the Symposium Proceedings publication.

The subject matter should be of general interest to Amateur Radio operators involved in satellite communications. Suggested topics include:

- Operating techniques
- Antenna design and construction
- Spacecraft design and construction
- Current mission status
- Proposed satellite missions
- Telemetry acquisition and relay

Copy ready papers must be received by August 15, 2003. Electronic submittal is preferred (MS WORD format). Please email your electronic submittals to Wayne Chandler at ve3whc@amsat.org ■





AGM 2003 Toronto

**AMSAT-NA Symposium and
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Before September 15	30.00 USD		
After September 15	35.00 USD		
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Alternative Spouse's Program

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Friday Oct. 17	Chartered bus to downtown Toronto and return trip	16.00 USD		
Friday Oct. 17	Shop and Dine Tour of Toronto	23.00 USD		
Saturday Oct. 18	Tour of historic Casa Loma	23.00 USD		
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Remembering Gerald Schmitt, KK5YY - Silent Key

Outstanding Amateur Radio Operator and Friend of AMSAT

Gerald Schmitt died suddenly Friday, May 23, 2003, in Albuquerque.

Jerry worked for Los Alamos National Laboratory for 22 years and had planned to retire in June. He and his wife planned to go to Alaska, a place that had captured his imagination for many years.

An outgoing man with a great sense of humor and a passion for learning new things, he had excelled over the years in a vast array of interests and activities. He was a pilot, an outdoorsman, an Amateur Radio enthusiast (KK5YY), a rescue SCUBA diver, a Ski Patroller, a photographer, equestrian/farrier, motorcyclist, car restorer, marksman, computer whiz - to name only a few.

But most importantly, he was a perpetual Good Samaritan, a stranger to no one and an adventurer extraordinaire.

*You can not stay on the summit forever.
You have to come down anyway.
So why bother in the first place?*

*Just this:
What is above knows what is below.
But what is below does not know
what is above.
One climbs, one sees, one descends.
One sees no longer, but one has seen.*

He is survived by his wife, Barbara of Los Alamos; his daughter, Cindy and her husband David Bardwil of New Jersey; his daughter, Lynette and her husband Ivan Busch of Arizona; his daughter, Rowena Macdonald of Arizona; his sister, Susan Reynolds of Florida; five grandchildren and another on the way, two nieces and a nephew, several close-knit cousins and other relatives.

Jerry was a very influential and valuable asset to all of ham radio. He was well known in the amateur satellite and APRS communities, a net control operator for the New Mexico Swapnet, an efficient communicator during the Cerro Grande fires. Jerry was the designer and main promoter of the Arrow Antenna used for satellite work as well as a developer who improved the operation of many popular radios.

Chris, N2YQP, recalls meeting Jerry and getting to know him. Chris wrote, "I first met Jerry about 7 years ago when he did one of his satellite demos at the Socorro



*Recent Photographs of Jerry at the Dayton Hamvention taken the week before his death.
(top) Thanks to Tom Clark W3IWI; (bottom) Thanks to Keith Pugh, W5IU.*



hamfest. He had the same HT as I had, and to see him make contacts all around the country with only an HT and that Arrow antenna, I went right over and bought one.”

Chris said he has been using his arrow antenna ever since, including for several QSOs with Jerry. “The best contact was when we made a half watt contact with Jerry at the Anchorage hamfest and myself at the Albuquerque hamfest. That contact was over two thousand miles and was a thrilling experience to have shared with him”.

Brian, N5GZT, wrote about the first time he met Jerry, “Like Chris, I met Jerry through a satellite demo he provided at a hamfest, many years ago. I figured, ‘gee, this guy thinks he can work a better part of the world with only a 2-watt HT and handheld antenna!’” He picked me out of the crowd and asked if I could do the antenna pointing for him. As soon as I got the hang of what to do, and listened to him say hello to regulars on AO-27 in CA, UT, VT and others, I was hooked. That, I later found out, was his intention.”

Chris’ thoughts are what all who knew Jerry are thinking. “He was a great friend and wonderful person. I will miss not hearing him on the air, whether it be on the birds or doing the Thursday night swapnet. He will be deeply missed. My heartfelt condolences go out to his wife, Barbara”.

An informal gathering of friends and family was held at 2 p.m. Sunday, June 1, 2003, at Pajarito Mountain Ski Lodge.

In lieu of flowers, the family suggests a donation to the Denali Sled Dog Kennels at Denali National Park, PO Box 9, Denali Park, Alaska 99755, or to a favorite charity in Jerry’s name.

*Do not stand by my grave and weep
I am not there. I do not sleep
I am a thousand winds that blow
I am a diamond glint on snow
I am the sunlight on ripened grain
I am the gentle autumn rain
When you wake in the morning hush
I am the swift uplifting rush
Of quiet birds in circling flight
I am the soft starshine at night
Do not stand by my grave and cry
I am not there . . . I did not die.*

73 Jerry, and all the best from your friends at AMSAT! ■

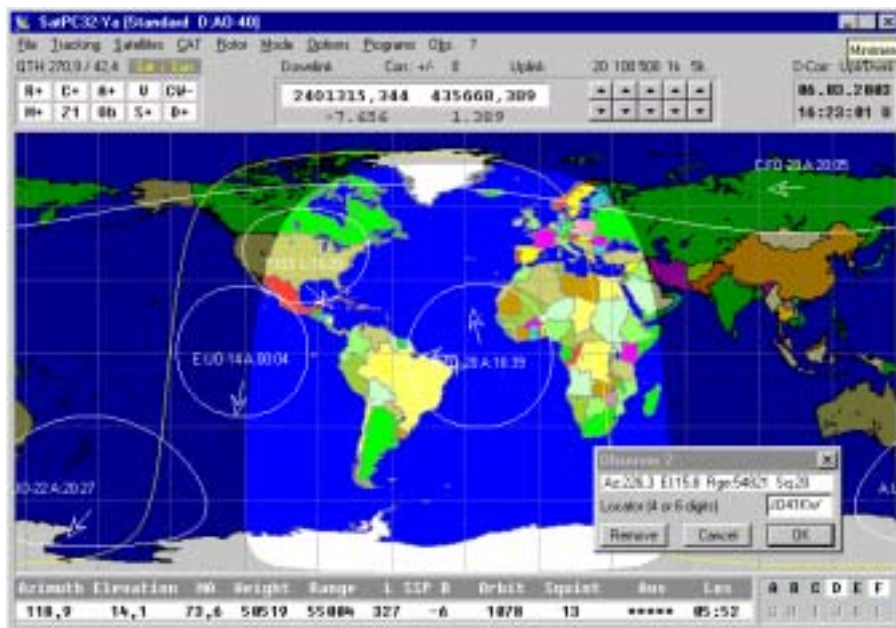
AMSAT is now the North American distributor of **SatPC32**, a tracking program designed for ham satellite applications. For Windows 95, 98, NT, ME, 2000, XP. **Version 11.2 now supports FODtrack rotor controller.**

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The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



Satellite DX by Wayne Estes, W9AE

Several satellite operators have been traveling on vacation or work-related trips. The return of AO40 to optimal alone is also stimulating major new AO40 DX operations.

RECENT DXPEDITIONS

VP2EAG (Anguilla). Drew KO4MA made two business trips to Anguilla in May and June. He didn't get a license until the end of the first trip, but he did make some UO14 contacts on the last day. In addition, he operated two UO14 passes during a day trip to St. Martin (FS). On the second trip he carried a small AO40 station as well. The hastily assembled compact station consisted of an 18-inch dish, Arrow yagi, FT-790mkII, and FT-817. His limited operating time tended to coincide with AO40 windows to Europe. During the 2 trips Drew made a total of 146 contacts with 27 DXCC entities. 70 of the contacts were on AO40. Drew expects to return to Anguilla soon.

9Y/K5OE (Trinidad and Tobago) Jerry K5OE went on a short-notice business trip in late May, and was able to make several UO14 contacts using an HT and a Pryme AL-800 whip antenna. He also hand-carried a downconverter to 9Z4BM who will hopefully be on AO40 soon.

5T6M (Mauritania, grid IK28). Frank DL8YHR was on AO40 from June 29 through July 6. This operation wasn't publicized in advance to North American satellite operators. He made his first appearance during Field Day. QSL via ON4ANT.

V31/N5WD (Belize) Wayne N5WD plans to be active on UO14 from Belize July 15-21.

FUTURE DXPEDITIONS

7P8TA (Lesotho). Frosty K5LBU is planning to operate AO40 from Mole's Hoek in the Kingdom of Lesotho July 18-25. Frosty is not an experienced satellite operator, but KK5DO has been teaching him the operating techniques, and W9AE loaned an AO40 antenna kit. QSL via the operator's home call.

CT3/CT1EAT (Madeira). Francisco CT1EAT plans to operate on AO40 from Porto Santo, Madeira July 23-30. This will be the first AO40 operation from Madeira,



The VP2EAG AO40 antennas consisted of an Arrow yagi on a camera tripod and a 18-inch DSS dish on a chair. The downconverter was powered by 6V lantern batteries. The radios were powered by 12V from the car.



While operating AO40, Drew had a nice view of the island of St. Martin in the distance. The radios are visible on the dashboard.

and the first-ever satellite operation from grid IM13. QSL via CT1EAT direct or via bureau. Francisco plans to activate more rare satellite DX locations in the future.

JD1YAB (Ogasawara) A group of hams is operating from Chichi-jima island from June 10–August 31. They have AO40 satellite equipment, but not many operators have expressed interest in using it. Let's hope the one of the operators will eventually activate this rare entity on AO40.

VK9X (Christmas Island). October 4-11. DX bulletins now report that this large DXpedition by 4 German hams will include AO40 satellite operation. Hams in the eastern U.S. won't have a window, but hams in the central and western U.S. will have short windows.

VK9C (Cocos-Keeling). October 11-23. The Christmas Island team also plans to operate from Cocos-Keeling. Short windows will be possible for U.S. hams west of the Mississippi River.

TZ (Mali). August 12-23. Doug, N6TQS, will be the AO-40 satellite operator for a DXpedition to Bamako, Mali. QSL via EA4URE.

Doug Faunt N6TQS and Rolf Niefind DK2ZF are each planning multi-location satellite DX operations in early 2004. The author wishes to apologize for getting Doug's callsign incorrect in the May/June column.

Please send reports of planned future DXpeditions to w9ae@amsat.org. Feel free to contact the author if you are interested in satellite operation from a rare country and want operating tips or loaner equipment.

QSLs RECEIVED

FG/W9AE (also sent via bureau), XR6M (Mocha Island, Chile), GJ6LVB, VP6DIA.

To provide better communication within AMSAT, we are adding member's e-mail addresses to our database. Please complete this simple form and send your information to:
member-info@amsat.org

This information will be kept confidential.

E-mail Address: _____

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AMSAT Jewelry Contest Revived

By David Guimont, WB6LLO

We are revisiting the annual AMSAT jewelry contest, with the winner to be announced at the convention in Toronto this fall. Everyone is entitled to one entry. Duplicate submissions will result in a void. You *do not* have to be present at the convention to win. E-mail, letter, telephone or on the air contacts are all acceptable.

This is the ninth annual contest after a short absence. Leanore, KA6UCD, refuses to be seen in public, wearing jewelry in any other place than those she has she has previously modeled!!

So this year we will repeat with a lavalier to follow up on the first contest won by Franklin Antonio. He correctly identified that piece of jewelry as coming from an ignition module of a 1982 Oldsmobile.

The AMSAT Jewelry Contest Mystery ... What is it?



The picture can also be seen in color on-line at:
<http://home.san.rr.com/doguimont/uploads/lav03.jpg>

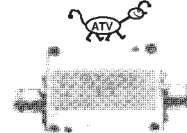
The Contest Rules

1. Describe as accurately as you can the source of the lavalier.
2. In the event of a tie, the tie breaker will be to estimate the resistance in ohms, in decimal, of the total wire in the windings assuming all segments are in series. The wire is enameled copper, .010" in diameter.
3. We will answer any questions concerning the rules, but NONE concerning other descriptions of the lavalier.

Convention goes will have until 1600 on the day of the banquet to give your answers to either Leanore or Dave. Forms will be provided at the convention for your answer, or just put them on a piece of paper.

Or, anyone can submit your answers via e-mail to wb6llo@amsat.org or ka6ucd@amsat.org ■

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AMSAT OSCAR-E Project

Summer 2003 Status Report

by Richard M. Hambly W2GPS

This status report about AMSAT-OSCAR-E ("Echo") is a companion article to the presentation given at the Dayton Hamvention in May 2003 and the to the previous articles published in the AMSAT Journal^{1,2} and CQ/VHF^{3,4}.

The AMSAT OSCAR-E satellite, also known as "Echo", was conceived by the AMSAT Board of Directors when on October 8, 2001 they initiated review of "a new small satellite project." Since that time an expanding team of AMSAT volunteers has been working in cooperation with our contractor SpaceQuest on the design, construction and launch preparations for this new satellite.

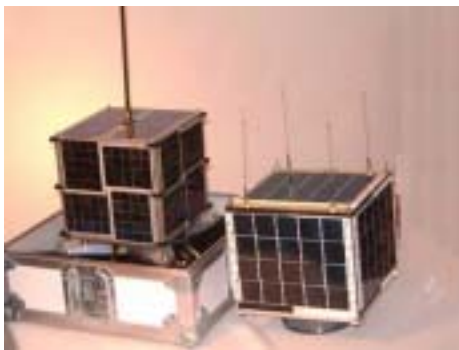


Figure 1: Original Microsat model (left) and Echo mechanical model (right)

Echo is a Microsat class satellite that owes a great deal to the heritage of the original AMSAT Microsats AO-16, DO-17, WO-18, and LO-19 that were launched in 1990 and to the AMRAD-sponsored Microsat AO-27 that was launched in 1993. As shown in Figure 1 Echo is a small cube about 9.5" (25 cm) on a side, like those first Microsats. It is made up from a stacked set of aluminum trays and covered on all sides by solar panels.

SUMMARY OF FEATURES

Echo will offer capabilities that will appeal to users with a wide range of interests from "EasySat" operations to scientific experiments. Here are the highlights:

- Mode V/U, L/S and HF/U Operation. Modes V/S, L/U and HF/S are also possible.
- Analog operation including FM voice.
- Digital modes. Store and forward operation is planned. Many speeds are possible but 9.6, 38.4, 57.6K and 76.8Kbps are the most likely.

- PSK31 repeater mode using 10-meter SSB uplink and UHF FM downlink.
- Four VHF receivers and two UHF high power 8 watt transmitters.
- Can be configured for simultaneous voice and data.
- Has a multi-band, multi-mode receiver.
- Can be configured with geographical personalities.
- Advanced power management system.
- Digital Voice Recorder (DVR).
- Active magnetic attitude control.

TECHNICAL OVERVIEW

Echo's internal subsystems have been refined and modified since they were described in the previous articles. As you will see in the following figures significant progress has been made and Echo's hardware is taking shape.

As shown in Figure 2 on the next page, Echo is made up of a number of modules and subsystems including:

- Four VHF receivers.
- A Multi-Band Multi-Mode Receiver.
- Two UHF transmitters.
- Six demodulators and 2 modulators.



Figure 3: Echo's Trays

- Integrated Flight computer.
- Batteries, BCR, Regulators (not shown).
- Wiring harness, RF cabling.
- RF switching and phasing networks.
- 56 channels of telemetry.
- Magnetic attitude control.

STRUCTURE

As shown in Figure 3 Echo is made up from six trays each made from solid blocks of 6061-T6 aluminum and stacked with stainless steel sheer pins and four 4-40 tie-down rods. The tray dimensions are:

- Receiver tray: 58mm with 2mm base.
- CPU tray: 24.8mm with 2mm base.
- Charger tray: 24.8mm with 2mm base.
- Battery tray: 38mm with 2mm base.
- Payload tray: 58mm with 2mm base.
- Transmitter tray: 39mm with 9mm base.

Thus Echo has overall dimensions of approximately 9.5" x 9.5" x 9.5".

RECEIVERS

Echo has four miniature VHF FM receivers each consuming less than 40 mW of power and weighing less than 40 gm each. Each receiver has 2-channel capability although the second channel is not planned to be used. The sensitivity of each receiver is -121dbm for 12db SINAD.

TRANSMITTERS

Echo has two UHF FM transmitters that can be operated simultaneously. Each transmitter can be operated at any power level from 1 to 8 watts output. The transmitters are frequency agile in 2.5KHz steps and are tunable over about 20 MHz.

MULTI-BAND RECEIVER

Echo has a single all-mode receiver capable of receiving signals on the 10m, 2m, 70cm and 23cm Ham bands and possibly on other frequencies. Its performance is limited primarily by the performance of the broadband antenna, which will probably be shared with the 2-meter whip antenna.

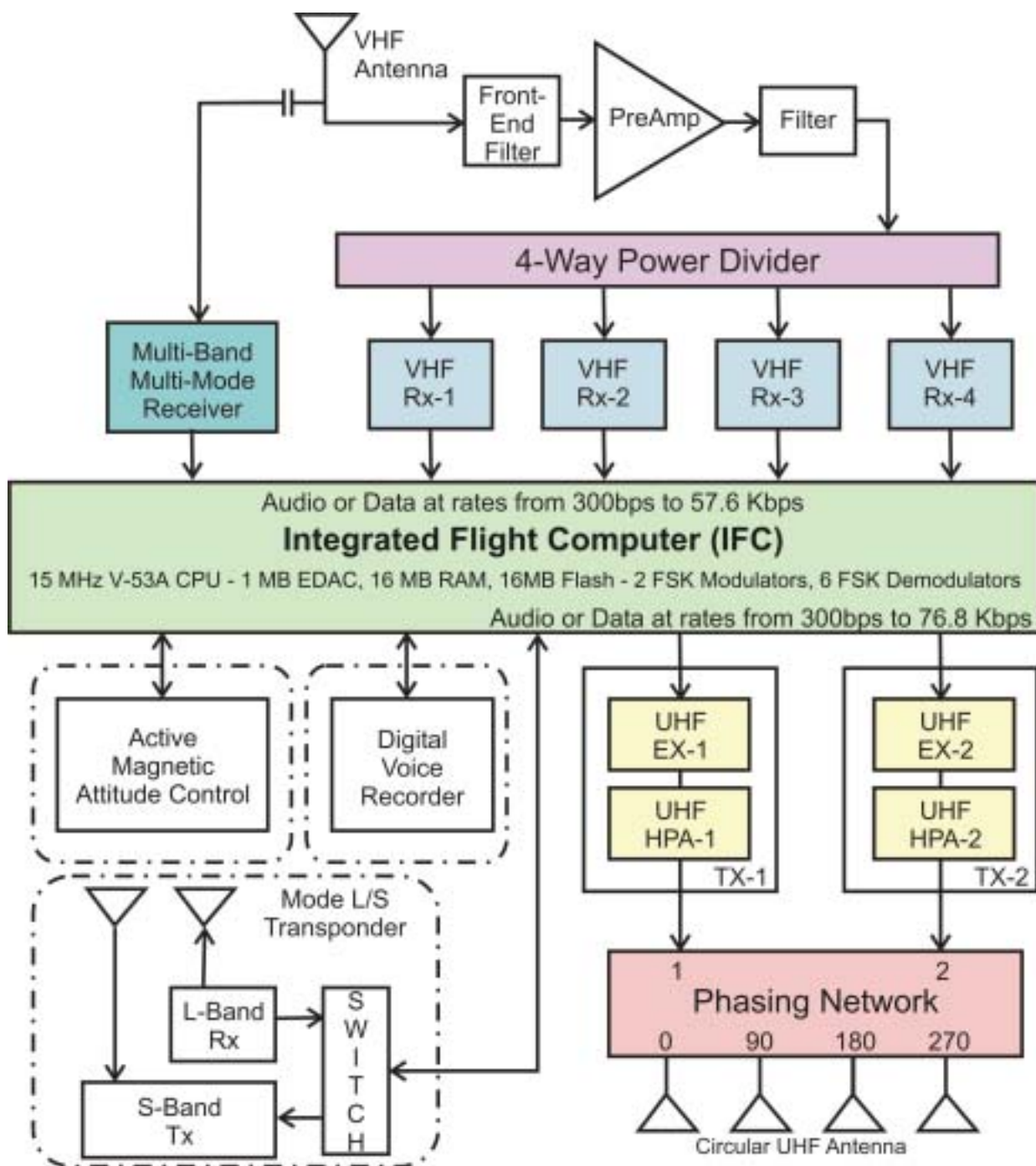


Figure 2: Block Diagram of the Echo Spacecraft

ANTENNAS

Echo's antenna design has undergone a number of revisions and is still in a state of flux. At present there are three antennas:

- A VHF 18" whip on top.
- A UHF "Mary" Turnstile on bottom.
- An L+S band "open sleeve" antenna on the bottom.

The Multi-band Multi-Mode receiver shares the VHF whip.

The two UHF transmitters are fed through a phasing network to the "Mary" UHF antenna, resulting in one UHF transmitter having right hand circular polarization and the other UHF transmitter having left hand circular polarization.

LINK BUDGET DATA

Echo's UHF transmitters are adjustable from 1 to 8 watts. Maximum efficiency is achieved at 8 Watts and that is the expected operating power level.

Antenna gain on UHF is +2 dBic at +/- 45 degrees to 6 dBic at the backside of the spacecraft.

The VHF antenna feeds a low noise amplifier (LNA) with 0.7db noise figure and 20db of gain. The LNA is followed by a band pass filter with 1.5db of loss. The overall receiver performance is -125 dbm for 12db SINAD.

DATA MODES

The modulation is either narrow band FM voice or data using baseband shaped raised-



Figure 4: Four VHF Receivers and Interface Board

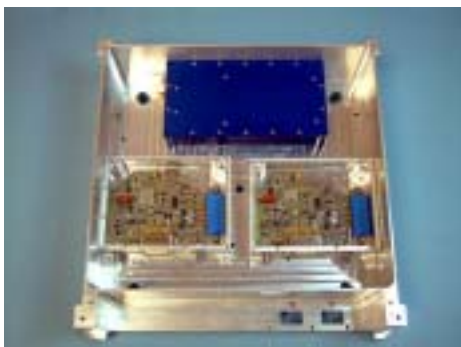


Figure 5: Multi Mode Receiver (rear) and two UHF Transmitters

cosine-in-time FSK. Many data rates are possible but 9.6, 38.4, 57.6 and 76.8kbps are the most likely rates to see operational use. To be more specific, it is expected that 9.6k and 57.6kbps will be used on uplinks and 9.6, 38.4, and 76.8kbps on downlinks.

The 57.6kbps waveform is about 100 kHz wide so it can't be used on the VHF uplink. The L-band uplink utilizes the multiband receiver that has both narrow and wide band filters. Unfortunately, the 57.6k L-band uplink will be less than optimal because the receiver's wideband FM mode bandwidth is 150kHz; it will take extra uplink power to overcome the additional noise from the mismatched filter bandwidth.

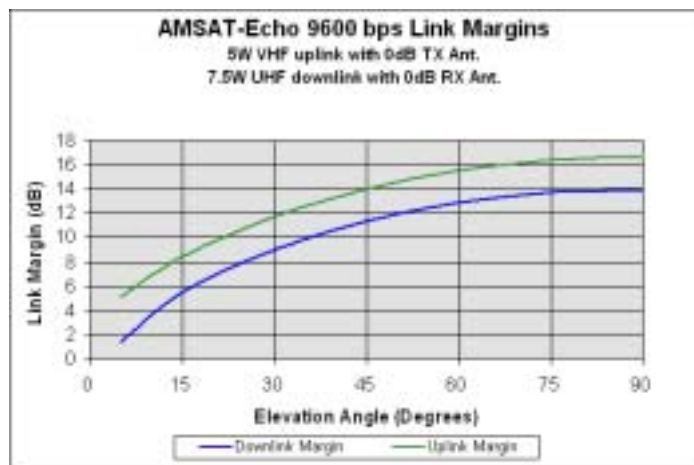


Figure 6: Mode V/U Link Margin Graph

Downlinks will be 9.6kbps on UHF (57.6kbps is possible but not likely). Downlinks on S-band will be 9.6kbps initially with 38.4kbps and 76.8kbps in use later. I expect we will run Sband at 9.6kbps to test and get folks with AO-40 stations interested, then move to 38.4kbps and 76.8kbps to get users excited about those faster speeds and gain experience on how they work with regard to Doppler.

We are looking forward to using 57.6kbps, however no ground equipment currently exists to support it so operation of uplink or downlink at this speed will have to wait until some equipment becomes available.

INTEGRATED FLIGHT COMPUTER

The Integrated Flight Computer (IFC) was developed by Lyle Johnson KK7P. It is a flight proven board with a power consumption of less than 300 mW. The IFC includes advanced features including six receive and six transmit serial communication channels, 1 MB of error-detecting and correcting (EDAC) memory, 16 MB RAM, and 16MB flash memory for mass storage.

The IDC also has six agile demodulators and two agile modulators to support data communications.

SPACECRAFT FLIGHT SOFTWARE

Echo's software consists of a boot loader, kernel, operating system and applications. Echo will use the Spacecraft Operating System (SCOS), which has been used on all of the Amateur Radio Microsat projects to date. Harold Price NK6K should be thanked for allowing AMSAT to use SCOS.

The software development team consists of Bob Diersing N5AHD, Jim White WD0E, Harold Price NK6K, Lyle Johnson KK7P, and Skip Hansen WB6YMH.

Bob Diersing N5AHD has agreed to update the boot loader. A test version of boot loader is now complete. This is the first step to enable the rest of the software effort.

The SCOS kernel port has started.



Figure 7: Integrated Flight Computer

Enhancements are planned to be made to the SCOS drivers and supporting software.

A Windows command and telemetry program for the ground station is about 50% complete at the time this is being written. A Windows based boot loader prototype for the ground station is done. The housekeeping task has been created and will soon be tested.

The communication protocol for the Digital Voice Recorder interface is documented.

SOLAR PANELS

Echo will have six high efficiency Solar Panels. The panels will use triple junction MCORE GaAs cells that are nearly 27% efficient. This results in about 20 watts of power generation capacity when not in eclipse (12-14 watts per side).

POWER DISTRIBUTION

Echo is equipped with a matched set of six NiCd cells that have a capacity of 4.4 Amp-Hours each. The output of the battery subsystem is nominally 8 volts DC. The interface between the solar panels and the batteries is through the Battery Control Regulator (BCR). This critical subsystem is designed to be autonomous and fail-safe so that the batteries are protected above all else.

The BCR operates at 50KHz with 89% efficiency. It charges the battery using only solar panel power, so is capable of charging a dead battery. The BCR prevents the battery from overcharging or depleting completely at any temperature and provides the necessary voltages and telemetry.

ATTITUDE CONTROL

A new experimental active magnetic attitude control has replaced the passive system used on previous Microsats. This design



Figure 8: Mark Kanawati N4TPY Preparing to Bond Solar Cells to the Panels.



Figure 9: Battery Tray



Figure 10: Battery Control Regulator



Figure 11: Active Magnetic Attitude Control

by Doug Sinclair VA3DNS consists of a torquer rod and a charging module.

The torquer rod is a semi-permanent magnetic rod whose strength and polarity are adjustable by applying a charging current over a period of up to 15 seconds, where 15 seconds imparts a maximum charge. This allows some control over the

satellite's attitude relative to the Earth's magnetic field. It also permits us to turn the satellite upside down.

DIGITAL VOICE RECORDER (DVR)

Echo will be equipped with a multi-channel digital recorder. This recorder can sample audio from a selected receiver output with 16 bits resolution at a rate of 48k samples/second. Recordings can be played back on any of Echo's downlink channels.

The DVR is based on the same ARM7 processor planned for use in the IHU3 for upcoming high-orbit missions. It has up to 64MB of RAMdisk storage, providing almost 12 minutes recording time.

INTEGRATION LAB

Thanks to the efforts of Ron Parise WA4SIR, NASA Goddard Space Flight Center has returned the AMSAT Integration Lab to us. This building was constructed in the spring of 1978 on the grounds of what is now the NASA Visitor's Center by NASA and a group of hams led by Jan King W3GEY and Tom Clark W3IWI.

The Integration Lab was used between 1978 and 1988. It was instrumental in the construction of the Phase 3A satellite and Oscar-10.

The Goddard Amateur Radio Club has helped to clear the building of the materials stored there by the Visitor's Center. We are now waiting for NASA's facility department to repair the roof and floor. Once that is done we will bring in furniture and test equipment, much of which will be provided by NASA and the Goddard Amateur Radio Club.

We are also assembling a satellite command and test station for this facility. Fortunately our satellite antenna tower is still standing and is in good condition.

LAUNCH

Echo's launch is planned for May 2004. The launch will be on a Dnepr LV (SS-18) rocket from the Baikonur Cosmodrome in Kazakhstan.

CONCLUSION

AMSAT OSCAR-E ("Echo") has evolved and matured since its inception in late 2001. Many of its modules are now built and undergoing preliminary testing. Software is beginning to come together. Soon we will



Figure 12: AMSAT Integration Lab at NASA

begin the system integration where the various subsystems will be tested in functional groupings. Then we will proceed with full satellite integration and testing.

By this time next year the Echo satellite should be in orbit providing communications services to the Ham community for many years to come.

NOTES

¹ "AMSAT OSCAR E, A New LEO Satellite from AMSAT-NA", AMSAT Journal, May/June 2002, pp5-11, Rick Hambly W2GPS

² "AMSAT OSCAR-E Project Status Update, A New LEO Satellite from AMSAT-NA", AMSAT Journal, November/December 2002, pp14-17, Richard M. Hambly W2GPS

³ "AMSAT OSCAR E, A New LEO Satellite from AMSAT-NA", CQ/VHF, Summer 2002, pp13-20, Rick Hambly W2GPS

⁴ "AMSAT OSCAR-E Project Status Update, A New LEO Satellite from AMSAT-NA", CQ/VHF, Winter 2003, pp12-13, 72-74, Richard M. Hambly W2GPS



Figure 13: Dnepr LV (SS-18) Launch from Baikonur Cosmodrome in Kazakhstan, December, 2002

Autodesk Case Study: Radio Amateur Satellite Corp.

Inventor™ Makes Ham Radio Satellite Designers Faster, More Productive

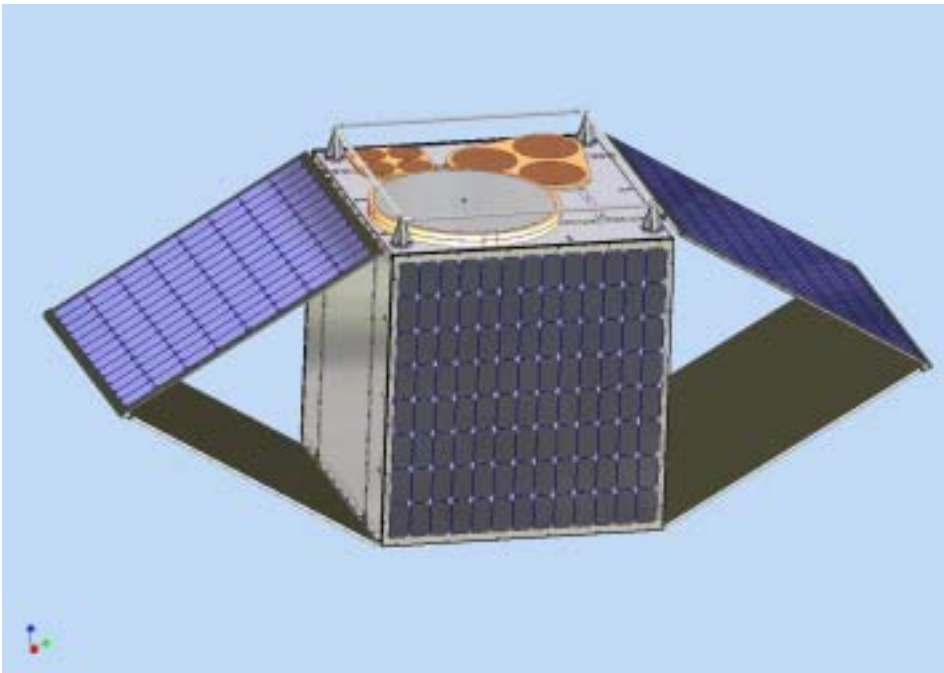
This case study was prepared by DLT Solutions of Herndon, Va.
(www.autodeskgovernment.com), Autodesk's master government sales and marketing partner.

Most people think of space flight – the launching of huge rockets that pierce the starry roof of the earth, hurtling out into the weightless void – as being beyond the reach of ordinary people. Those satellites orbiting the earth are fussed over by hundreds of white-coated NASA whiz kids, their intricate spaceframes and circuitry

founding in the early 1960s. Amateur ham radio operators – whose equipment still works when telephone lines go dead and cell-phone signals jam up or drop out, making “hams” handy in emergencies – got into this business because satellites allow them to relay their radio signals across thousands of miles. To build satellites, the organization gathered ham radio users

around the world who volunteered their engineering skills. AMSAT has often relied upon surplus or donated material, small financial contributions from members, discounted launch rates from space agencies, and a keep-it-simple scientific approach. Fortunately, they had a lot of talent available: several technological breakthroughs pioneered by AMSAT are now commonplace in the satellite marketplace.

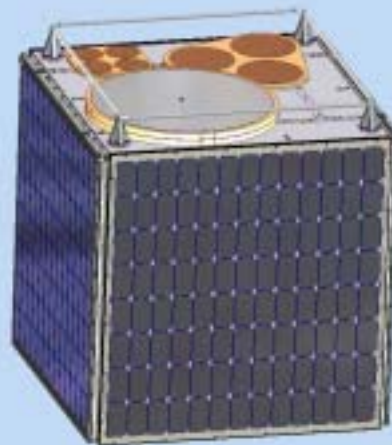
AMSAT is now at work on a new satellite project, Eagle, that is expected to be launched in 2006. Because satellites have a finite life span before their orbits decay, new ones have to go up every several years. AMSAT engineers are now working to solve design challenges associated with keeping their “birds” in a high, elliptical orbit, which will give them maximum exposure to ham radio users, while still generating solar power year-round instead of powering off during certain seasons. To help with this task, AMSAT recently began using Autodesk Inventor™, a 3-D modeling



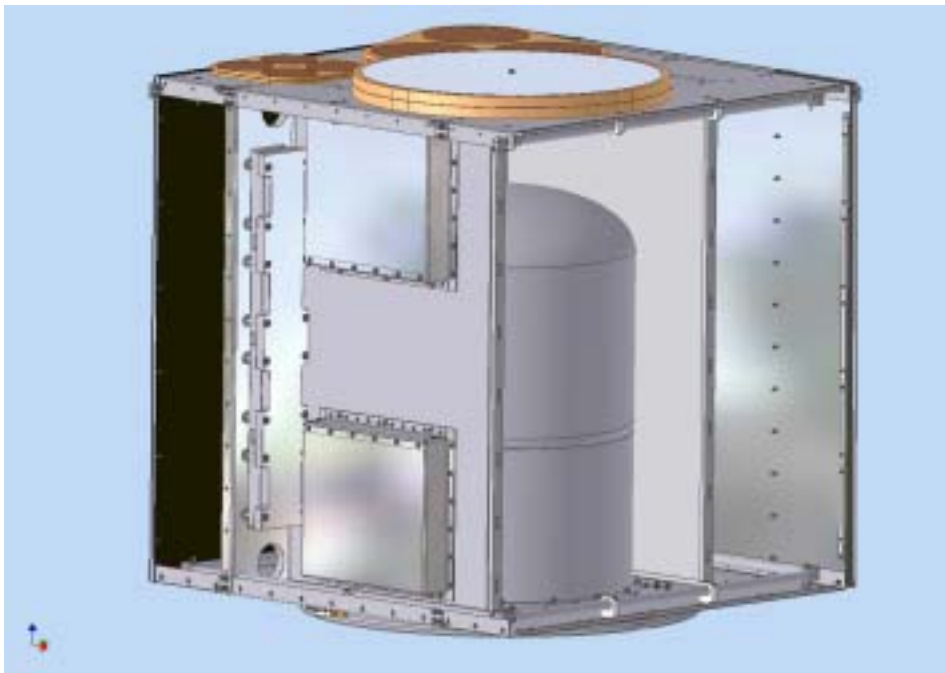
conceived and tested in high-security labs, right? When they hitch a ride out of the ionosphere, it's thanks to billions of dollars spent by the governments and giant multinational corporations who can afford to do something unimaginable, like hiring a space rocket. The rest of us – we just watch.

Well, it turns out that's not exactly true. With enough creativity, dedication and brains, functioning satellites have been put together by people working in their basements and garages. There are satellites orbiting now whose motors were cobbled from leftover parts, whose guts are held together with fiberglass rails cooked in a kitchen oven, and whose antennas started out as a cake pan bought at Kmart.

They were made by a group of global ham radio enthusiasts called the Radio Amateur Satellite Corp. (AMSAT), which has launched more than 30 satellites since its



(top) Eagle with solar panels deployed; (bottom) Shows solar panels stowed.



(top) Eagle assembly view showing transmitter module location.

(center) Eagle assembly view showing wiring harness holes.

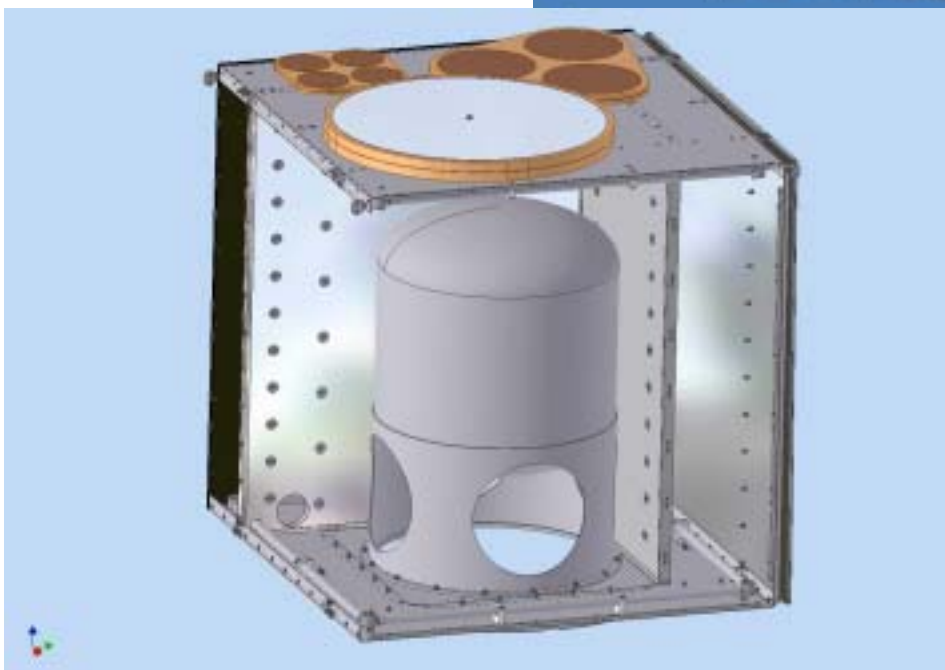
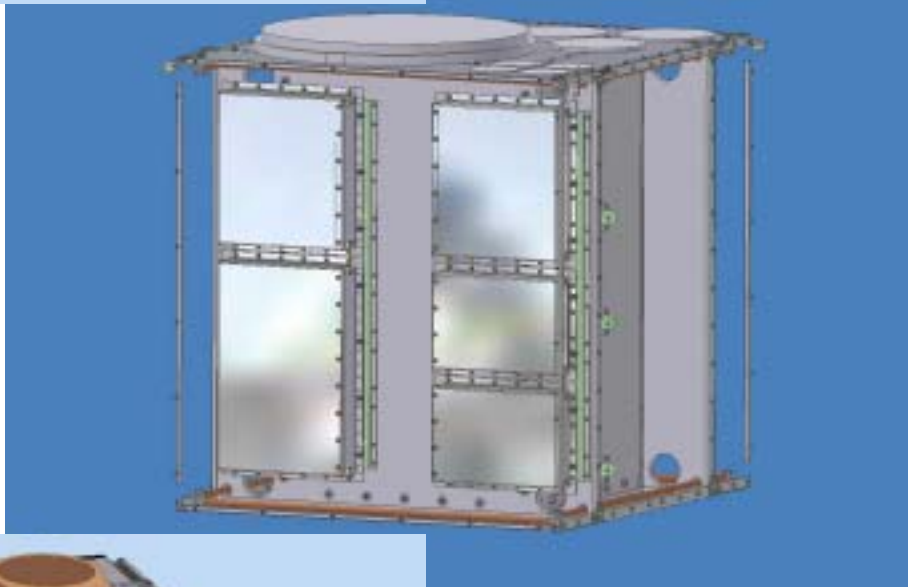
(bottom) Eagle assembly view showing propane tank.

Vandenberg Air Force Base in the 1970s were also low-earth orbiters, but were launched higher and lived for several years each. Some of these satellites were called “Microsat,” and were as small as 9-inch cubes that usually held one or two digital transponders and a powerful computer that received and forwarded radio signals from earth.

platform that has allowed the group to visualize new designs and produce complex, lifelike drawings much more quickly and efficiently than before.

Bigger and Better Satellites

AMSAT’s trajectory, as it were, has consisted of three phases. Its Phase I satellites, starting in 1961, were called OSCARs (Orbiting Satellite Carrying Amateur Radio). A class of satellite called LEO for low earth orbit, OSCARs I, II and III contained relay beacons and had lifetimes measured only in days or weeks. The Phase II OSCARs launched from California’s

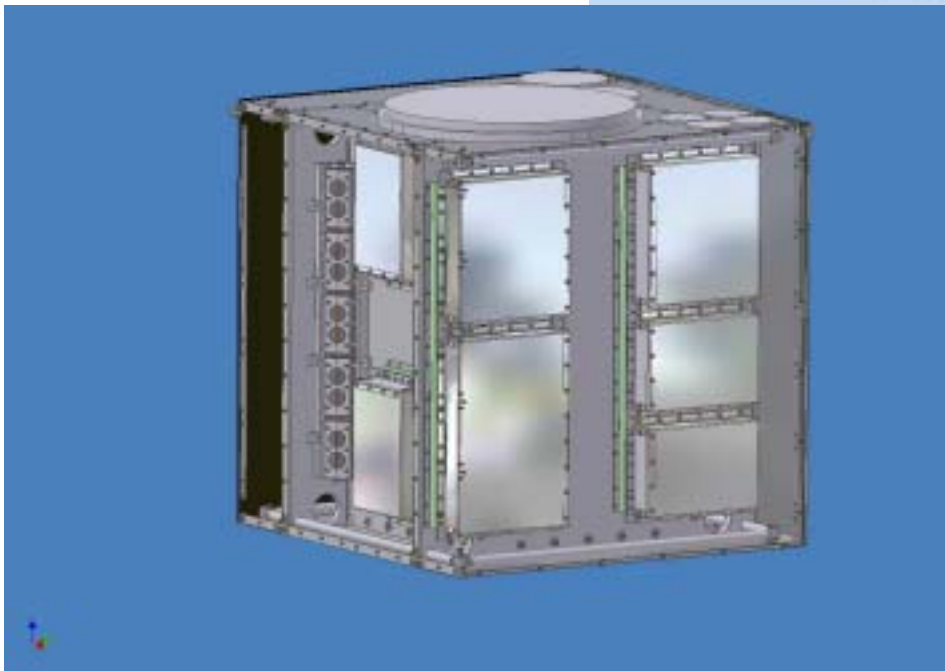
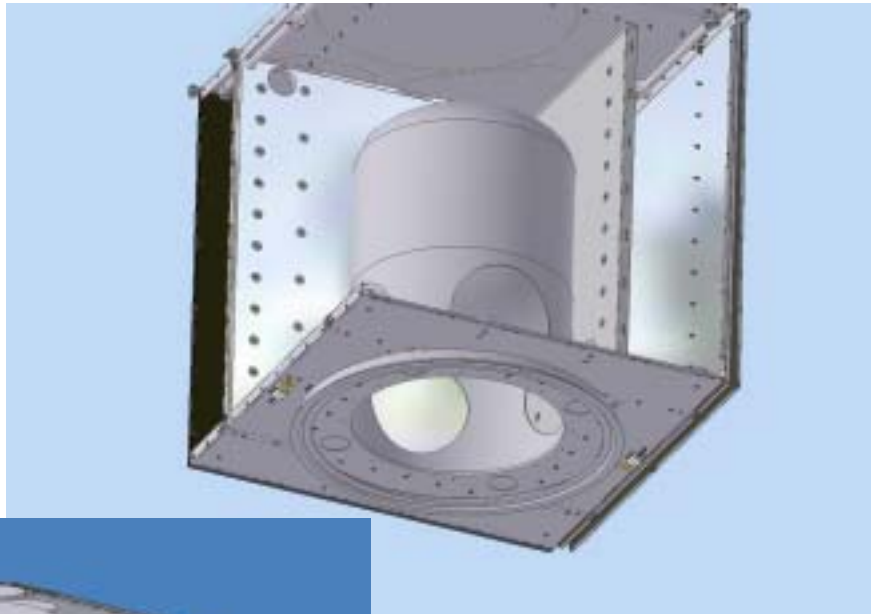


In the 1970s, AMSAT began its Phase III program, a series of satellites that were designed to be launched into high-altitude orbit, with more sophisticated and diverse high-power transponders. Because they orbit farther away, their signals can reach an entire hemisphere of the earth, allowing ham radio users longer access time before the satellite moves past the horizon.

As with any long-term space flight project, there have been setbacks. In May 1980, AMSAT proudly launched the first of its Phase III satellites aboard the European Space Agency’s Ariane 1 rocket from Kourou, French Guiana. Three minutes after liftoff in rainy weather, the rocket’s first stage booster failed disastrously, plunging the satellite into what AMSAT engineer Dick Jansson calls “sub-oceanic orbit.”

Jansson, a resident of Maitland, Florida near Orlando, is a retired thermal designer whose career has included work on the hypersonic X-15 aircraft, thermal designs for ballistic missile guidance systems at the Massachusetts Institute of Technology, satellite instrument designs for Honeywell and a stint at Lockheed Martin. Jansson first became interested in ham radios because they used the same frequencies as the remote-controlled model airplanes he liked to fly. Like all ham radio operators, he passed a licensing test and was given a call sign (WD4FAB), and soon he was pointing his antenna at whichever OSCAR satellites

(right) Bottom view showing P3 attachment.



(above) Eagle assembly view showing module installation.

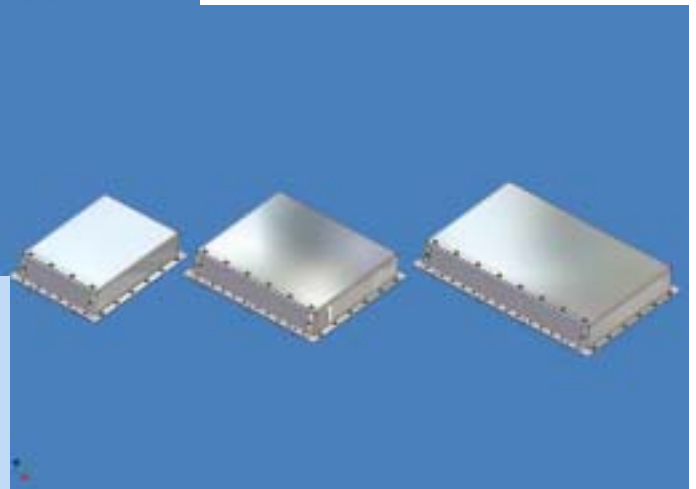
(right) Electronic module housings.

(below) Eagle support fixture.



happened to be *floating* within range at the moment.

When a back injury led him to retire on disability, Jansson was able to devote himself full-time to AMSAT's volunteer corps of engineers. He started on the ill-fated 1980 launch, but succeeded with 1983's Oscar 10. He then helped to produce four LEO Microsats in a "furiously busy" 27-month period between late 1987 and 1990, for which Jansson handled almost all the mechanical and thermal design work.



In 1990 Jansson began working on a complex satellite called Phase 3-D, led by the German wing of AMSAT, which involved contributors from 14 countries. Over the next 10 years, Jansson made 20 trips to Europe and devoted what he estimates was \$1 million worth of his time to the project. In 1996, the Discovery Channel's "Eyes in the

Sky” program came to Orlando to do a segment on AMSAT, and Jansson and others were filmed shopping for parts at an electronics surplus store and a Kmart. (That’s where he found the cake pan that he used as a prototype for one of Phase 3D’s antennas; the fiberglass mounting rails that he cured in his wife’s oven were used for the early Phase 3 satellites). Finally, in November 2000 after a decade of painstaking work, the Phase 3-D satellite – a 2meter-diameter hexagonal cylinder laden with radios, cameras and experimental equipment, the largest AMSAT satellite ever– streaked skyward from French Guiana on an Ariane 5 rocket, its \$5million launch tab paid for by AMSAT donations. After its launch, the satellite’s name was changed to AO-40, for AMSAT OSCAR 40.

‘A Tenth of the Time It Used to Take’

To draw up his satellite designs, Jansson began learning Autodesk’s AutoCAD 9 in 1987. “I got pretty proficient on it,” he said, eventually settling on AutoCAD 14 for the duration of the AO-40 project. “All the engineers on the project were using an AutoCAD standard, because we were passing drawing files back and forth, first by floppy disk and then over the Internet with the Germans,” Jansson said. “For the most part we used 2-D CAD drawings for the satellite – we had about 200 of them; on paper the stack was two and a half inches thick. Toward the end we started drawing things as 3-D objects, and from that point on the writing was on the wall.”

Jansson said that when he “got a sniff of what Autodesk Inventor could do,” it seemed like a promising tool. Other 3-D mechanical design programs had been difficult for him to master, but after a one-week class “I was off and running with Inventor, and I haven’t looked back since. It was very easy to learn to use.”

Jansson is now using Inventor to knock out designs for AMSAT’s next high-orbiting satellite, Eagle, which has a project team of about a dozen people and a hoped-for launch date of 2006. Along with improved communications electronic components (the internal gizmos that Jansson calls “the sparkies”), Eagle is being planned with spaceframe and solar panel changes that should allow it to generate constant solar power no matter what its angle to the sun or its position in earth orbit.

“Inventor is just a vastly superior way to create a design,” Jansson said. “I’m much more productive than I’ve ever been. I can

create a particular part and it’s not a drawing. Generating 2D drawings from the 3-D design is just fantastically easy to do; I can do it in about a tenth of the time it used to take me, and I was very experienced with AutoCAD.”

‘Keep It Simple, Stupid’

Jansson said 3-D modeling has made big differences in the way people visualize objects. “Unless you’re trained to imagine how 2-D drawings will look as finished products in the real world, it can be difficult,” he said. “But when you start out from the beginning dealing with 3-D objects – rotating them, seeing them from different angles, looking at surfaces – even a lay person can see exactly what you’re talking about. They look very realistic.”

Jansson said that his emerging 3-D model for Eagle already has some 6,500 parts, including every nut, bolt and rivet. One of the design challenges he is dealing with is spin balance; the weight of the satellite, a 60-centimeter cube, has to be distributed enough that it will rotate cleanly on its desired spin axis in space when launched. To do this, Jansson uses Inventor’s Properties function to get a bead on the “mass moments”, CG location, and value of inertia for different design options.

“Achieving a spin balance is painful to do,” he said. “But because I can read out the values directly from Inventor as the design progresses, I don’t have to guess about them, so it’s much easier to correct them directly. All those factors can be sorted out at the beginning; it’s really slick.”

Jansson also said that Inventor is based on a simpler, intuitive approach to modeling that he had not seen in earlier 3-D mechanical engineering programs, which demanded weeks of classes and even then were difficult. This reflects AMSAT’s own philosophy of engineering. “It’s KISS: ‘Keep It Simple, Stupid,’ “ he said. “We believe that you should re-use parts of designs whenever you can, and don’t re-invent something that has worked well in the past. This reduces documentation to the bare minimum, making sure that other people can easily duplicate your work. If you look at AO-40, that project had a commercial value of \$80 million, but the entire design came down to about 200 CAD mechanical and another 100 electronic drawings.”

Very-Long-Distance Calls

The Eagle satellite’s internal components are still being drawn up, and AMSAT’s global

organizations have millions of dollars to raise to cover launch costs. When Eagle does go up, it will provide yet another “bird” for ham radio operators to use every day.

Most hams talk regularly with friends they’ve made around the world. For years, Jansson himself used his radios to chat with colleagues in Sweden and Japan, with no toll charge. Another benefit of satellite-bouncing ham signals is that you can make some very exotic contacts: In 1983, Jansson spoke with astronaut Owen Garriott when Garriott brought a handheld ham radio aboard the Space Shuttle STS-9.

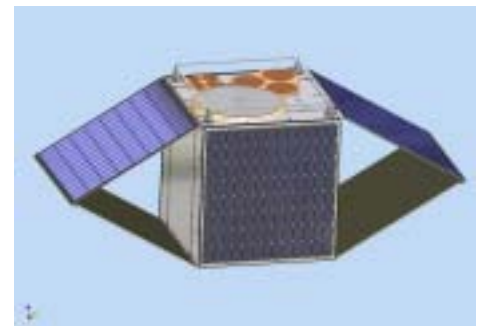
Since then, almost every shuttle flight has been outfitted with ham antennas and radios. So has the International Space Station: Russian astronaut Valeri Korzun, an avid ham radio buff who spent six months aboard the station in 2002, used the station’s four ham antennas to chat with friends back on earth almost every night before bed.

For his part, Jansson will have more time to enjoy his ham radio because he’ll be spending less time sweating over satellite drawings. Autodesk Inventor has reduced much of the time he used to spend laboring on 2-D designs and engineering calculations.

“Inventor just works more quickly and productively, in terms of man-hours, and I’ve picked up a lot about it,” he said. “When something comes along that makes it easier for me to do a job, I get pretty happy about that.”

AMSAT is a registered trademark for the Radio Amateur Satellite Corporation. The Radio Amateur Satellite Corp. is a 501(c)(3) educational, scientific, not-for-profit corporation.

AMSAT’s Inventor licenses were donated by Autodesk Inc. and supported by ImaginIT of Orlando, Florida. ■



AMSAT-Eagle

AMSAT-Phase-3-EXPRESS

The Project begins Its Journey

By Frank Sperber, DB6DBN

Pictures and drawings: W. Gladisch, H. Straube, F. Sperber; AMSAT-DL

Translation: John J. Bubbers, W1GYD

[This article first appeared in the AMSAT-DL Journal, March/May 2003. Ed.]

The first rough parameters for the P3-E-Project were outlined at the first meeting of the Phase-3-Design/Experimenter's meeting three months ago. Since October of 2002 a whole lot of decisions and actions have taken place including a meeting of the HF working committee, and the first discussions for a launch with our preferred partner, Arianespace. The P-3-EXPRESS-Mission has thereby already begun its journey.

A Home for P3E

It is commonly known that the P-3-predecessor AO-40 (P3D) was assembled in a facility in Orlando, Florida. The need for such a large facility is not required, because of the smaller size of our P3E. It is then reasonable to find a suitably sized facility in the home location, Germany, for the integration of a satellite of approximately 150-kg weight.

The Board decided to revert back to Marburg after reviewing several offers of integration facilities. The home location had been previously used for the integration of AO-10 (P3B) and AO-13 (P3C). The home location of Marburg [Germany] has the further advantage of having available important elements from earlier activities. Additionally, Heike Straube, who will manage the P3E project's logistics, is from a suburb of the location. This room is too small for the P5A Mars Mission Project and must therefore be excluded.

For about the past 15 years, since the construction of AO-13, this room has not been used for integration work. Accordingly, it would have to be set up again for the coming operations on the satellite. Thanks to Horst Wagner and Peter Osswald (Figure 1) since the end of January it can be used again for the work ahead, and the P3-E structure has already been brought into the room as can be seen in the picture.

This solution in Marburg was thereby very quickly available. At another location

valuable time would have been lost because of the required construction of the necessary infrastructure and modifications.

Work has begun

Many component aspects of the project were able to proceed since the beginning of November 2002. Included are many mechanical components, that Peter Osswald modified (Figure 1). These are the parts for the tube and for the mount of the earth and sun sensors. Several sources and proposals were reviewed for the core material for the magnetorquer and the magnetic coils for the attitude control in the earth's magnet field. Here it must be decided which materials best satisfy the requirements.

Dick Jansson has already completed a series of drawings for the so-called Clamp-Band. It connects the satellite to the carrier structure during the launch of the satellite. Several technical documents were able to be transferred for a potential CAM-Production in reference to the SBS. Since ARIANE 5 will carry large payloads in the future, it could be, that the SBS can be modified for its use depending on the configuration.

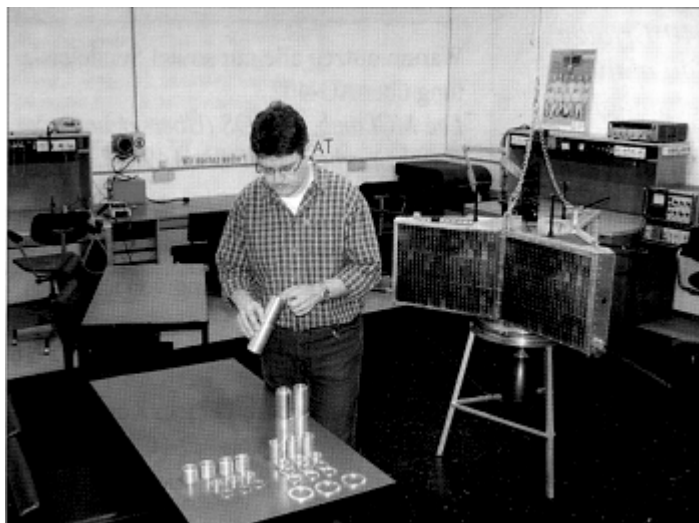


Figure 1: The recently renovated integration room. Peter Osswald in the foreground with several completed mechanical parts which he made.

Closely related is the development of the CAN-Bus-Module controllers by Lyle Johnson, Chuck Green and others. The board represents the interface between the CAN-Bus and the Module hardware (for example, the transponder, etc). All

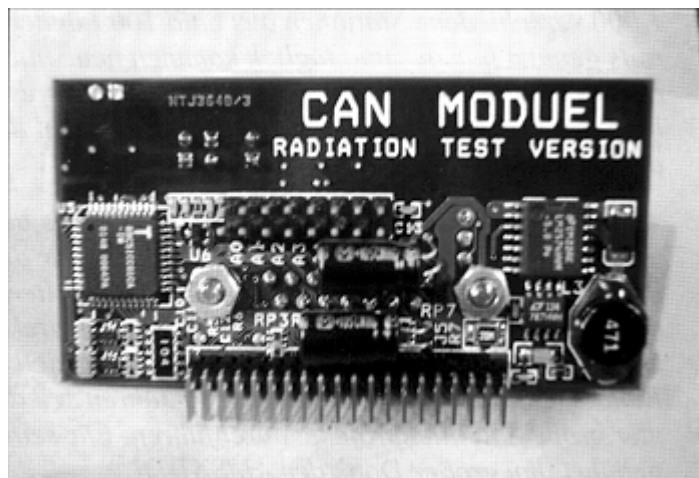


Figure 2: The CAN-Bus module controller prototype for the radiation test. This module is the intermediary for the on-board computer. The jumpers on the upper face are for test purposes and will be eliminated in the final version.

experimenters and module builders will have a uniform interconnection requirement.

The Module Controller is already available as a prototype (Figure 2) and will be accepted after radiation tests. For this the team of Bdale Garbee, KB0G, developed a part of the subsequent software. The IHU-3 is one of the potential processors and it must likewise be radiation tested.

Meanwhile, the first group of NiMH batteries has arrived in Marburg (Figure 3). Two groups of cells were ordered from different suppliers, from which compatible cells are still to be selected. As to the acquisition of solar cells, we are already one step further ahead, in that, previous contacts with a manufacturer have been reactivated.

HF Layout Established

Fifteen developers of the HF group met on January 25 and 26 to establish the bands, transponder combinations and interconnection relationships to the satellite. A configuration was found compared to AO-40 in spite of the smaller structure, that would offer Mode U/V

(previously Mode B) as an operational possibility for the beginning operators and continues the successful downlinks in the S and K Bands. The equipment configuration of AO-40 can be extended to P3-E by this continuity. Figures 4 and 5 show the communication payloads and the predefined locations of the different modules in the structure.

At the end of the discussions there were additional receivers in the L Band, C Band, and S Band on the list in addition to the Mode U/V transponder. Along with the transmitter in the S Band the U and L Band receivers should come into operation. The definite connecting on additional microwave bands was not fully decided. Since a definite IF level has been determined the combinations can be interconnected at a later date.

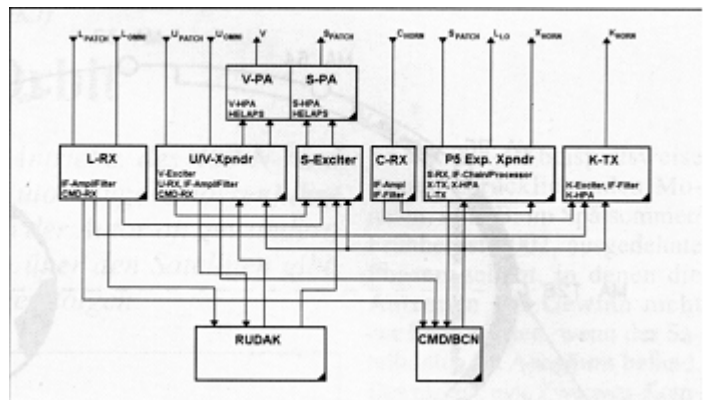


Figure 4: A first block diagram of the various transponders.

in close proximity to the earth which offers an improvement in the radiation pattern when the squint of other high gain antennas becomes too large. Naturally Modes U/S and conditionally L/S can be used at the apogee. Parallel operation of two transmitters is excluded because of the energy budget.

Launch Opportunities Discussed

Peter Gülzow had the first discussion with Ariane-Space colleagues on the launch possibilities starting last November. Two suitable possibilities appeared for the beginning of 2005. Several questions concerning the interface between satellite and rocket were addressed. Unfortunately, there was a serious launch failure of ARIANE 5 after this discussion. Jean-Michel Desobeau of Arianespace was able to address this solution to this event as well as further configuration questions at the end of January (Figure 7).

It is expected that there will be a delay of several months. The reason for the launch failure has in the meantime become known. Fortunately, this will not have any negative effects on future discussion for launch options for P3E and also P5A. Arianespace would like to have a similar opportunity in the future for further "auxiliary passengers" after the experience with the SBS configuration of the P3D (AO40).launch.

We are assuming that there will be additional news to present at the AMSAT-DL Symposium on March 22. Until then the first design concepts for the transponder payload and further progress for various components are anticipated.

Contributions are Welcome

In addition to all of the personal involvement of the contributing developers the Mission



Figure 3: Heiki Staube opens a delivery of NiMH batteries. The cells for the flight will be selected later.

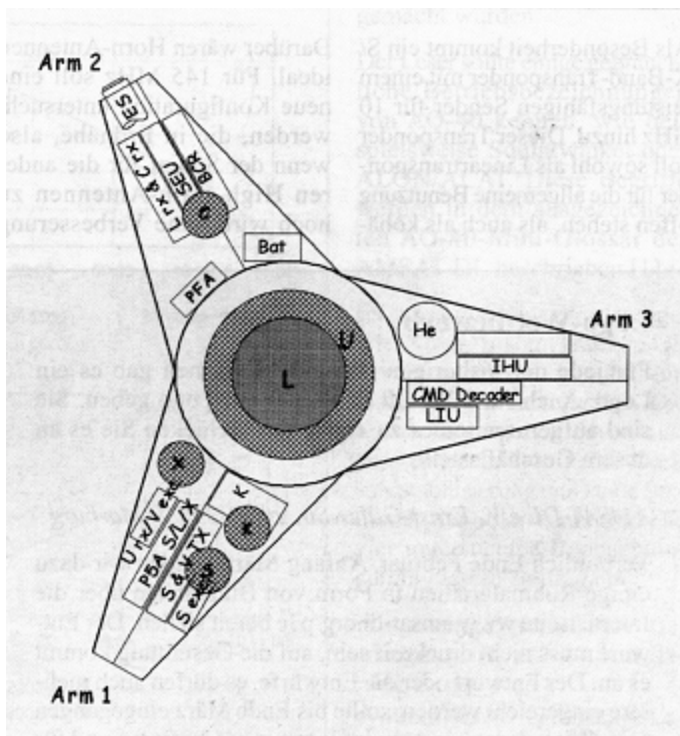


Figure 5: The preliminary module and antenna positioning on P3E.

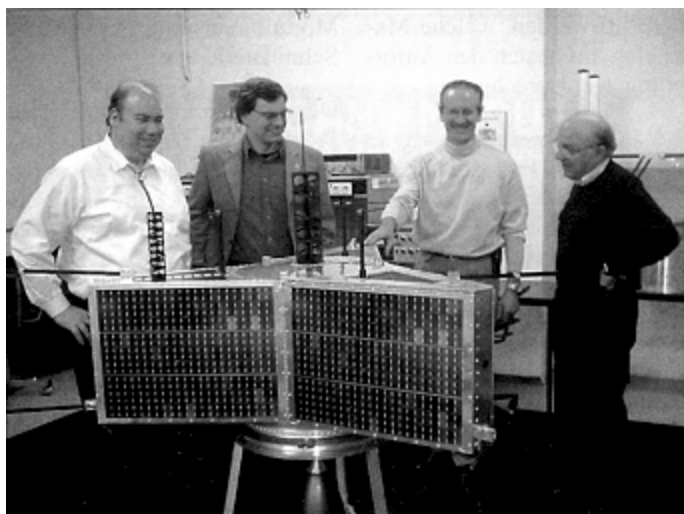


Figure 7: Discussions on the launch options for Ariane 5. Left to right - Peter Gulzow, Frank Sperber, Jean Michel Desobeau from Ariannespace, and Karl Meinzer.

needs financial involvement. In contrast to the earlier P3-Missions which also carried research projects, P3E is a pure Amateur Radio mission, which requires the community of the Amateur Radio's support for a large part of its support. The reserves of AMSAT-DL have secured the beginning of the project. Further supports will become necessary for the complete realization of this project. Your contribution to AMSAT Phase-3E will make the reality of this project possible. You may send a check or a contribution to the account of ASAT-DL. You can also contribute on line via the

www.amsat-dl.org/p3e. If you need a contribution receipt (over 50 Euros) please don't forget to send a copy to the AMSAT-DL address.

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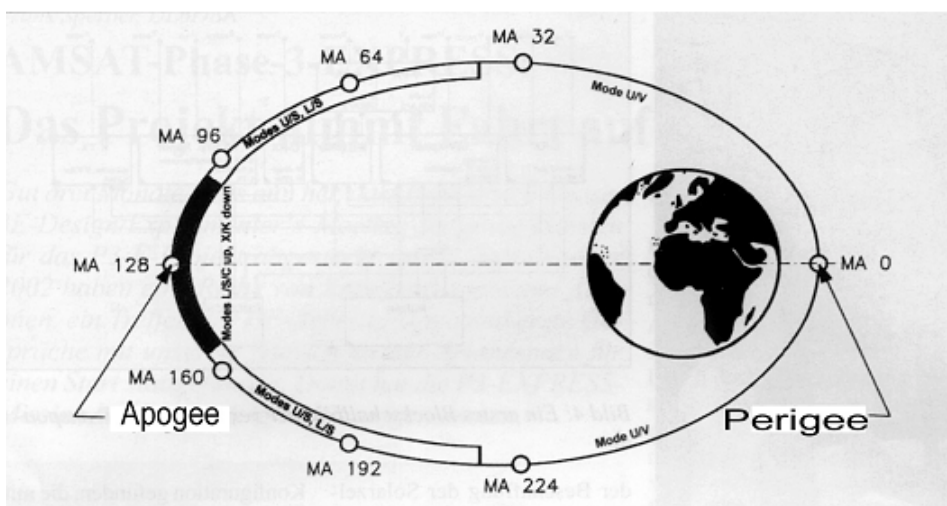


Figure 6: Depending upon the orbit phase and the resultant squint angle, the different transponders can be optimally used. There is something for everyone from Mode U/V (previously Mode B) to UL/S and up to Mode K.

AO-40 Birthday Bash

Beginning September 16, 2003, 0000 UTC and ending November 17, 2003, 0000 UTC AMSAT is sponsoring a bash to celebrate AO-40's 3rd birthday. SSB, CW and digital operations are acceptable for this bash. The AO-40 Command Team requests that CW and digital operations be performed with minimal power (QRP suggested) to keep the AGC down.

All hams worldwide are welcome to participate. Awards will be given out for Top Scores Worldwide, Stateside, Non-Stateside, and AMSAT-NA Member (with paid up dues). Runners up in each of the above categories will also receive an award. It is possible for one person to get one or more of the awards due to his particular location and score.

The exchange for the bash is call sign, grid square, AMSAT-NA membership number (for AMSAT-NA members), for non-AMSAT-NA members your year and month of birth (YYMM).

Example:

K5OE de KK5DO
KK5DO de K5OE EL29 12345
K5OE de KK5DO EL29 L34567 (L is used to indicate Life Member)
Or if K5OE were not a member, K5OE EL29 5511

Everyone is encouraged to participate and submit a score. Email logs will be accepted. All logs must be received by Bruce Paige, KK5DO on or before November 30, 2003. If not participating in the bash, please send your log as a check log.

Continued on Page 30 ...

Our AMSAT-NA Donors

Compiled by Mal Preston, NP2L

- 3 -

Continuing the practice started last year we are pleased to present this list of donors who have made financial contributions in excess of their annual dues. The list includes 617 donors from across the world who have provided \$91,400 in funding for Echo, Eagle, ISS and other projects during the period June 1, 2002 through May 31, 2003. It is heartening to note that the level of support during this uncertain period exceeded by 40% the average annual support in the 3 years before the AO40 launch. The AMSAT enthusiasm expressed by more than 12% of our dues paying members has to be the envy of any other ham radio activity.

In addition many of you contribute time and talent in many ways. We try to honor these at our awards dinner in the fall. Others have donated equipment, materials and services. Although our system doesn't let us put you on a list be assured of our thanks.

Many of the donations on this list have been designated for specific purposes. As always be assured that we scrupulously adhere to your wishes. If we have erred in preparation of this list please accept our apology and tell us about it. Donors contributing \$100 or more are shown in **bold** typeface and President's Club members as **PG** (gold), **PS** (silver), **PB** (bronze) and **PC** (our new core membership).

If you would like to consider joining the President's Club use the handy form on the back of the front page or call Martha at headquarters.

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KR4EO	PC	WALTER PONT	N5YVF	MIKE DONELSON		ANDERSON
KS4WX		HANK JENKINS	N15M	DAVID STEWART	WB6UYO	A. FRISBIE
KX4Y	PC	DIETER SCHLIEMANN	N15V	PC STEVE MUNCY		- 7 -
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N4QQ	PC	JOHN SHEW	W5DTR	CURTIS R. WILLIAMS	K7OLD	NORMAN MARTIN
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		HENNESSEY	W5PGZ	WILLIAM GRAVETT	KC7JOV	GILES SYDNOR
W4BOC		ALFORD MEMORIAL	W5RPS	KEN WENDEL	KC7JRU	SAMUEL LYNCH
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AG5M		RICHARD MEZNARICH	KO6BT	PC DUANE NAUGLE	K8OCL	JOHN CHAMPA
K5ENG		CHARLIE KENG	KQ6EA	PC JIM JERZYCKE	K8PNW	THOMAS L. MILLER
K5GM		PTERE JORDAHL	N6PAA	RONALD MILES	K8RQ	JAMES JAEGER
K5HV	PC	H VORDENBAUM	N6TE	PB HARRY BLUESTEIN	K8ZZU	JAMES SANFORD
K5MAN	PC	KARL SANDSTROM	N6TQS	DOUG FAUNT	KA8QCU	DOUGLAS KUITULA
K5NRK	PB	RUSS TILLMAN	N6UPL	JAMES DOUGLASS	KB8LEF	PC JOSEPH SENDER
K5PER		JAMES L. JONES	NN6RF	PC DON STIVER	KE8RG	JOHN DECKER
K5QXJ		NICK PUGH	W6AHD	CHARLES C. RUBEY	N8AYY	GARY WIDMAYER
K5UIC	PC	THOMAS BROWN	W6AQ	DAVE BELL	N8BMA	PC DAVID WANG
K5VRF		ROBERT C. SMITH	W6EI	PB ROBT IANNUCCI	N8DEU	PS TIM CUNNINGHAM
K6AWO		BILL DEWS	W6EJJ	PC JAY HOLLADAY	N8FGV	PC DAN SCHULTZ
KA5SMA	PC	MIKE MILLER	W6ETK	PC NORRIS NAHMAN	N8GUS	PC RON LONG
KA5Z		RICHARD JONES	W6ISS	PC TIM BOSMA	N8IGJ	PC ARMANDO
KB5SZO		EDDY H MOORE	W6KJ	RONALD MURDOCK		MERCADO
KC5WBV	PC	GEORGE HUMPHREY	W6OYJ	R.E. MUNN	N8NQF	RON SPALDING
KC5YRE	PC	JERRY ERVINE	W6PJ	PETE JUUL	N8OCX	BROOK D. SMITH
KD5MHC	PG	CHARLES GUNTER	W6XD	ARTHUR GODDARD	N8SAZ	PC SAM POWELL
KD5NJR	PC	SCOTT HALEY	W6XS	PC ROBERT MCNAIR	NE8I	PS LLOYD ELLSWORTH
N5AF		SAM NEAL	W6YEP	PC PATRICK FENNACY	W8ABZ	DALE E. REED
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N5DF		JOHN STENSBY	WA6FDI	PG ART WHELEN	W8IJ	DAVID BARROWS
			WA6ICW	DONALD LUM		

W81QV W81ZQ W8LIL WA8CBA WA8FKC WA8HFX WB8CSL WB8M WB8OTH WB8OUE WB8SBI WB8WLD WD8CDP WD8RBR		J.H. GARNER BERT HAYHURST BILL (W.J.) NEWILL PC ROBERT.C.BIGGS ANDREW SZUCS PETE GIBLIN PB WALT IRELAND WALLACE RENN PERRY YANTIS TOM CAIN JAY SCHWARTZ STEVEN COLLIER JIM BROWN HAROLD E. FINAFROCK	KORDT KA0SWQ KB0CY KB0EMR KC0COU KC0GPY KC0MV KC0FTQ KE0AZ KG0MC KOVG N00KW N0BYF N0UHH/N0 N0UU	DR. ERNEST W. HOUSE RICHARD AGNEW ROBERT WITTE PB R ECHTERNACHT KEN DURAN PC ELSA BRUNO EMERY P. SMOLA PC STEPHEN MORRACO DAVID BRUNNER JOHN CHICKAUL PC VERNON GOBLE PG ED ZIMMER FLOYD ROMSLO V J. & E. YANKO LAWRENCE STOSKOPF JOHN GUBBINS ALAN FELDMEIER PC JOHN CONNER CHARLES TROTTER TERRY SCHIELER PC JERE BRUNING RICHARD SULLIVAN ROY WELCH ED MEANS PC ED MEANS PG WILLIAM BUCKNER TELMER OLSON MAX BODEHAUSEN JOHN M. CONLEY TOM MIKKELSEN PB GENE POPE LLOYD V. TIMPERLEY, JR. NOEL J. PETIT WARD HALL DAVID WAGERS KALE GENTRY PC RANDY MCLEAN G.J. DEMOTT CLINTON GRIEVE, JR.	G3WGM G8GGI G6LVB GW1FKY HB9ABO HB9CXE HB9IBI HB9MQM HB9PL I0DYB I1CDB I1TEX I2FUM IK2AXV IK3ASM IK3VZS IV3VBE IW1PED JA6BX PA3FDM PE0PWA PE1ITR SV1AC PY1BDU TF3AM VK5APF VK5EU WISEMAN VK6JBL VK7KP XE1MEX ZL1MO VE2RM	PC JIM HECK MR. R.B. GEDDES PG HOWARD LONG PC KENE EATON MR. URS HADORN PC EMIL WALDER FRANCOIS BURRI PETER W.FREY PETER LANGENEGGER STEFANO DELL'UOMO MR. PIETRO FANCHIN MR. MICHELE SENESTRO ANTONIO FUMAGALLI PIETRO DELBONO REMIGIO PRESSI VINICIO ZORIN DOTT. G. GIRO MR. MAURIZIO RIVAROLA YOSHIO ESAKI HEINRICH VAN DER GEUGTEN PB P VAN DER WAL ROB HARDENBERG PC JOHN ANGELOPOULOS MR. WALTER PONTES DE FARIA ANDRES THORARINSSON PETER FORWARD GRAHAM C. ANDREW NILSSON MR. CHARLES J. ROBINSON ALEJANDRO DIAZ IRVING SPACKMAN PC WESTERN QUEBEC VHF/UHF ASSN.
AA9GY K9ATR K9BMC K9HF K9IJ K9KK K9KL K9LDW K9LF K9MWM K9NC K9QHO K9SB K9UML K9VWX KA9ETP	PC PAUL HISE MILTON GIBSON DON BRISSON PATRICK MARINEAU JOHN RICE PB RICK VIDMAR GREGG SEIDL PC LOWELL WHITE PG WILLIAM BROWN PC BOB LUDTKE JEFF HOEFT PC MICHAEL WILLIAMS TIM TOMJANOVICH ROBERT WILLETT DONALD HOGE EDMUND F GAFFNEY, JR	N0VSE N0XP NJ0C NW0X W0FM W0JDB W0RPS W0SL W0VO W0VO W0VZK W0YPT W0ZZQ WA0DCB WA0POD WA0QKU WB0ULX WB0VGI WC0Y WD0AUN WG0H W05M WT0PHD WY0C	PC JOHN T. BELL CARL PETERSON MIKE SEHNER PG N. LAUERMAN DR. JOSEPH LAHR JAMES SPAIDE PS MICHAEL BLAKE PC STEPHEN RENTMEESTERS GLEN OGLE NORMAN I HUBER PS WAYNE ESTES PC DAVE FILMER MAURICE J. MEAD WEST ALLIS RADIO AMATEUR CLUB PB GREGORY BEAT LIBERTYVILLE & MUNDELIN ARS JOHN PATTERSON JOE SCHROEDER PC DON MILLER MIKE GEE PB JOE GLICKAUF PG KERMIT CARLSON PC DAVID LIEB PC BRUCE RAHN THOMAS TROIKE JOHN LEEKLEY GEOFF GAVRILA JIM FITZPATRICK	VA3BJD VA3RR VA7GZ VE3BNO VE3EDR VE3FFK VE3FRH VE3FUL VE3NPC VE3OS/VE VE3SHO VE3YB VE4AMN VE7AFY VE7XQ VE9PI 7J1AJH 9V1VS 9M2OK CT1EOJ DL1FLW DL8VX EA1IW F6BKI F6CDK F6HLG F05RA G3VGW G3VZV	PC BARRY DELONG RUSS RENAUD FRED ZELTINS MR. G. ROACH BRICE WIGHTMAN MIKE KELLY PG ROBIN HAIGHTON H.E. KING PC L.CLAIRE FOWLER MR. IAN MACFARQUHAR SYLVAIN HOULE MR. C.R. OAKES GREG MASON MR. & MRS. R. DARCUS MR. A.M. CRAIG PC JAMES DUNFIELD - DX - JIM TITSLER T.K. JAYARAM PC OTHMAN ISMAIL LUIZ DUARTE LAWRENCE WILLIAMS MR. W. PUENJER PC ANTONIO F SANCHEZ JACQUES RAMBAUD MR. PIERRE KUNTZ GEORGES FAIN JEN-LOUIS MARIDET MR. R.I. BUCKBY PS GRAHAM SHIRVILLE	OTHER SUPPORTERS ARI SEZIONE DITORINO PS CLAUDE BOUSSEMART AMAL CHAUDHURI AMATEUR ELEC. SUPPLY AUCKLAND VHF GROUP INC BIRGER LINDHOLM CENTRAL STATES VHF SOCIETY DARRAN SIU DENNIS KELLY ELAINE HANSEN GREGORY T. MARTENS HELEN REED OTTAWA A.R.C RICHARD H. ROBERTSON RONALD GEYER SOUTHEASTERN VHFS PB THOMAS JELKS JR WILLIAM CARRICO ZUU-CHANG HONG ANONYMOUS
AB0NJ AF0SS K0CY K0GEO K0GRM K0GS K0HML K0IQE K0MDJ K0OV K0PQ	FRANK RODEFFER HOWARD ROBB BOB MCCAFFREY JAY CLOSE DENNIS MURPHY GEORGE H. SAUM RALPH BOLT ALVIN GLUSICK PB MARK JOHNS JOE MOELL STEPHEN BANKS					

AMSAT Awards By Bruce Paige, KK5DO, AMSAT VP-User Services and Awards Manager

Congratulations to these amateurs who recently earned the following OSCAR Satellite operating awards:

Satellite Communicators Club

These operators have recently made their very first satellite QSO. May they have many more years of fun on the satellites.

Stephen Ayling, SO5AS
Mark Herrick, KL0AD
Patrick Stoddard, WD9EWK
Bob McWha, AD5NQ
Edward Lock, KE8FK
Russell Hack, Jr, NM1K
James Bundy, KC5LTN
Marsha Bundy, KD5MAJ
Tracy Sanders, KD5IMM
Emily Clarke, W0EEC
Angel Santano, WP3GW
Joel Black, W4JBB
Leon Bishop, N5PU
James Hall, WB4YDL

AMSAT Satellite Communication Achievement Award

376 Joel Black, W4JBB
377 James Hall, WB4YDL
378 Mark Herrick, KL0AD
379 John Lee, K6YK
380 Emily Clarke, W0EEC
381 Bob Witte, K0NR
382 Rick Rogers, K5RCR

OSCAR Sexagesimal Award

130 John Lee, K6YK

OSCAR Century Award

33 John Lee, K6YK

AMSAT South Africa Award

US76	W4JBB	Joel Black
US77	W0EEC	Emily Clarke
US78	K5RCR	Rick Rogers

To see these awards and to find more information please visit:
<http://www.amsatnet.com/awards.html>

Except for the K2ZRO Engineering Award, applications for all other AMSAT awards should be sent to Bruce Paige, KK5DO, at:

PO Box 310
Alief, TX 77411
USA

The K2ZRO Award will continue to be handled by the AMSAT main office via:

850 Sligo Ave., Suite 600
Silver Spring, MD 20910-4703



YACER (Yet Another Camera Experiment) For Windows Program Suite

For those Radio Amateurs interested in the AO-40 Spacecraft technology & Science, Gunther Meisse announces the availability of the YACER Package.

You can now capture, view, and analyze the YACE Camera Images and determine the spacecraft Alon/Alat directly from the telemetry beacon raw data stream, or from the AO-40 Archives.

This Package includes all the software and documentation of the software, used by the AO-40 Command Stations in their day to day ascertainment of the spacecraft ALon/ALat. Now you can do it yourself, in the shack.

The YACER Package (YACER 1.01 (2.9M) is available for download from AMSAT at <http://www.amsat.org/amsat/ftpsoft.html>.

The YACER Package is distributed at no charge. If you like it and use it, why not send a reasonable contribution (say \$20.00) to your AMSAT organization. More money means more birds! You are requested to send your donation to:

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| ■ Ultra Low Noise LNA's 50.0 MHz. 24.0 GHz. | ■ Mode "L" TX Upconverters |
| ■ Transverters 50 MHz. - 24.0 GHz. | ■ Linear Amplifiers 50 MHz. - 24.0 GHz. |
| ■ Antennas - Rotors | ■ Ultra Low Loss Coaxial Cable |
| ■ Downconverters and TX Upconverters for all P3D frequencies | ■ Transverter Kits 1.2, 2.4, 5.7 & 10 GHz. |
| | ■ Parabolic Dishes |

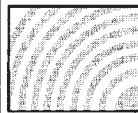
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A Small Beam for 70cm

By Lee McLamb – KU4OS

If you've ever wanted a small lightweight beam antenna for the 70cm band, here is a wide band hand-held beam antenna that is easy to build and guaranteed to improve your signal. I use the antenna along with the 2m rig and $\frac{1}{4}$ wave trunk mount antenna already in the car for quick roadside contacts on the FM satellites UO-14 and AO-27. However, due to its wideband design, it would also be useful for ATV work or getting a bit more range to hit a repeater.

In my case, I had borrowed a small 70cm beam to activate some rare grid squares on a vacation trip. I enjoyed that so much that I wanted a small hand-held antenna I could leave in the trunk of my car all the time and pull out quickly for roadside satellite passes. Inspired by K5OE's 3 element, 70cm, Handi-Tenna¹, I set out to see what I could construct.

My goals were that the antenna had to be:

- 1) Flat enough to lie in the trunk without getting too mangled..

- 2) Short enough to fit in the trunk

- 3) Light enough to point by hand for 15 minutes at a time.

- 4) Cheap enough that should it get mangled, it wouldn't be a major loss.

With all these goals in mind I began looking at antennas that had already been designed. I decided that K5OE's design with the folded dipole feed would probably get quickly crushed with the shifting contents of my normally cluttered trunk. Next, I checked the web site of well-known antenna author L. B. Cebik, W4RNL. There I found the design for a 4 element wide-band yagi² that was ideal for my application.

The actual antenna is just under 16 inches from the reflector to the 2nd director. By mounting the antenna on a 2-foot boom of $\frac{3}{4}$ inch PVC there was enough pipe left at the rear to use as a handle. The most impressive thing is that this little antenna has about 9 dBi of gain and an SWR under 1.3:1 across the entire 70cm band from 420 MHz to 450 MHz. Another feature that I found very attractive was that the feed point impedance is 50 ohms. This allows for simple direct connection of the coax to the driven element.

Construction

The original design by L. B. Cebik was based on using $\frac{1}{2}$ inch copper pipe for the elements. Since weight and budget were major considerations, I built mine on a boom of $\frac{3}{4}$ inch PVC pipe and $\frac{1}{4}$ inch tubing that I had left over from other antenna projects. First, I cut the boom into two pieces so that, using a PVC coupling, I was able to feed the cable through the boom up to the feed point. The front section of boom is 13 inches long and holds the driven element and two directors. The remaining piece holds the reflector and be the beam's handle.

Mark the location of Dir. 2 two inches from the end of the 13 inch piece of PVC. Then, using the dimensions in the table, mark the locations for the other director and driven element. I made my driven element using two pieces of copper tubing 6 $\frac{1}{2}$ inches long. I then pounded $\frac{1}{2}$ inch of one end on each piece flat and bent it at a 90-degree angle to serve as a mounting tab and connection point for the coax. Drill a hole for a #6-32 screw in the center of each tab. Then, with the tab facing the rear of the antenna, line the driven element up to its place on the boom and mark the location of the hole in

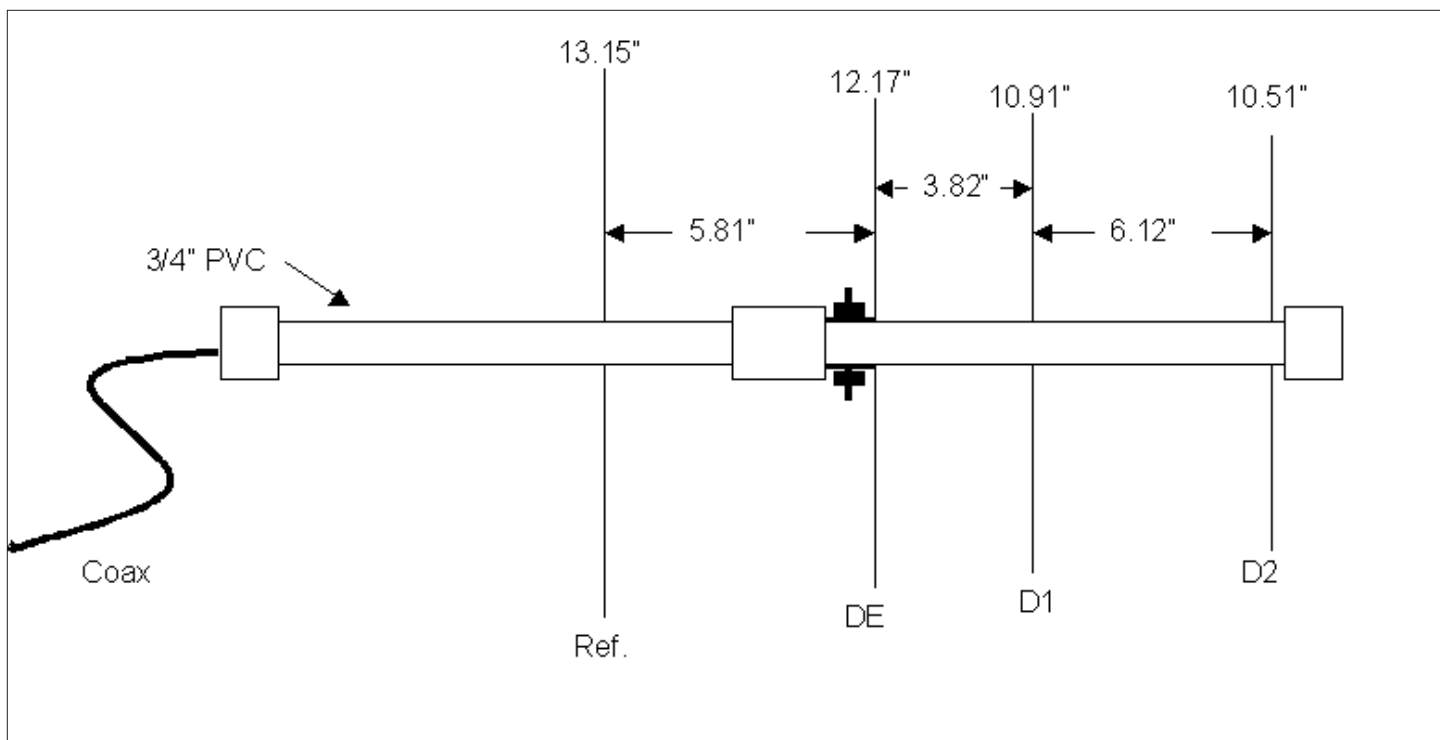
the mounting tab. Next slip a PVC coupling onto the end of the boom and attach the back end of the boom. Measure back and mark the location of the reflector. Finally, drill the holes for all four elements and slide the two directors and reflector into place.

I drilled a hole just large enough to slide the RG-8X feedline through a PVC end cap mounted on the rear of the antenna. The coax has the shield and center conductors terminated with ring terminals. A pair of #6-32 x $\frac{1}{2}$ " stainless steel bolts/nuts/washers feed through the ring terminals and boom from the inside and connect to the driven element tabs on the outside. As a final, touch I put another PVC end cap on the front end of the beam to help give it a more complete appearance.

Once I had the antenna assembled I swept the entire 420-450 MHz 70cm band and found that the SWR was in fact 1.3:1 and below across the entire band. On my first try with the new beam I was able to start making contacts through UO-14 at just 3 degrees above the horizon. The beam has turned out to be a great performer and met all my goals. It has allowed me to activate several grids during my travels as well as



Lee, KU4OS, shown demonstrating his small 70cm beam operating via satellite during the Boy Scout Jamboree-On-The-Air



4-Element Wide-Band Yagi Dimensions				
Element	Length		Spacing from Dir. 2 (D2)	
	Inches	mm	Inches	mm
Reflector	13.15	334	15.75	400
Driven Element	12.17	309	9.94	252.5
Dir. 1	10.91	277	6.12	155.5
Dir. 2	10.51	267	-----	-----



Hey! This thing really works!

having the Boy Scouts make satellite contacts during the Jamboree on the Air last fall. A final unexpected benefit has been that when I want pack the antenna for an airline trip, I can slip the elements off and put them inside the boom and toss it into the suitcase.

Reference

1. <http://members.aol.com/k5oejerry/handi-tenna.htm>
2. <http://www.cebik.com/wb46.html>
Full design information also appears in Chapter 5, "Wide-Band Utility Yagis for 420-450 MHz," in the CDROM book, Wide-Band Yagi Notes, vol. 2: Practical Antennas, available from <http://www.antennex.com>. ■

AMSAT at the Dayton Hamvention 2003

Photos by Tom Clark, W3IWI

(We've tried to identify as many people as possible in these photos, Ed.)

1. (L) Keith Pugh, W5IU

2. (L-R) Molly Hardman, W0MOM; Martha Saragovitz, AMSAT Office Manager.

3. (L-R) David Bern, W2LNX; Rick Hambly, W2GPS.

4. (L-R) Robin Haighton, VE3FRH, AMSAT President; Keith Pugh, W5IU.

5. (L-R) Bob McGwier, N4HY; Jerry Schmitt, KK5YY (SK); Robin Haighton, VE3FRH; David Bern, W2LNX.

6. AMSAT Symposium, Front Row, L-R Rick Hambly, W2GPS; Bdale Garbee, KB0G; Robin Haighton, VE3FRH; Gould Smith, WA4SXM.

7. (L-R) Bob Carpenter, W3OTC; Martha Saragovitz.

8. Bdale Garbee, KB0G.

9. (L) Robin Haighton, VE3FRH.

10. Gould Smith, WA4SXM.

11. Rick Hambly, W2GPS.



To see all of the photos please visit Tom's web site at:
http://www.pbase.com/tomcat/amsat_at_dayton





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11

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Help Support Project Echo!

... Continued from Page 21

Postal submissions may be made to:
Bruce Paige, KK5DO
PO Box 310
Alief, TX 77411

Logs from logging programs should be in Cabrillo format or exported in ASCII with the same fields as the paper logs but may be

in the order that the logging program exports them. (i.e., SSB might be logged as USB/LSB by the logging program or Grid might be exported before AMSAT #/Birthday)

All paper logs should be in the following format:

Date (YYYY/MM/DD), Time (UTC), Call sign, Grid Square, AMSAT # or Birthday (YYMM), SSB/CW, Point Value
2003/10/16, 1400, KK5DO, EL29, L34567, SSB, 3
2003/10/17, 0100, K5OE, EL29, 12345, CW, 4
2003/10/17, 0105, XX1XX, EL01, 5509, USB, 1

Those participating in the bash are encouraged to submit a weekly total by category so that we can have a running history of activity. These scores will be posted without call signs so as not to give away who has what score. Please submit the weekly score to kk5do@amsat.org ■



Dale Hershberger, KL7XJ, in Soldotna, Alaska, uses a **SatEL Az-EL!** to mount a 3' N3IYR circular polarization offset dish for his AO-40, 2.4 GHz downlink, and a M2 70 cm 11 element Yagi for his uplink. Dale is about to install a DEM RHCP helix for a 1.2 GHz uplink.

AZ-EL on a Budget! SatEL's Az-EL! with Control Processor and two Windows® drivers, seen at Dayton last May. "We do dishes!" (3 ft.)

Track AO-40, the space station, and LEO sats at a fraction of the cost. Uses sat pass data exported by either *InstantTrack®* or *Nova for Windows®*.

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AO-40 Birthday Bash Scoring Rules	
Contact with an AMSAT-NA Life Member	
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CW/Digital	6 points
Contact with an AMSAT-NA Member	
SSB	2 points
CW/Digital	4 points
Contact with a non-AMSAT Member	
SSB	1 point
CW/Digital	2 points



AMSAT Satellite Demo in Puerto Rico

Photos by Angel Santana, WP3GW



(left) Angel, WP3GW, working UO-14 at the Hamfest in Carolina, Puerto Rico. He worked K3SZH, K5OE, and XE2AT on this pass.

(below) Tony, KP4IA, working UO-14 from his mobile. The eggbeater antenna was inspired by a K5OE design.



(above) Tony and Angel shown introducing the hamfest crowd to the satellite gear.

(right) Angel also brought along his amateur television gear for a demo. Close examination of the screen shows the Delta rocket awaiting launch for the MER-1 mission to Mars.



Remember to take photos of your satellite field activities and send them to the AMSAT Journal. Our e-mail box is: journal@amsat-na.org.

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 Tone Scan • Built-in Keyer • PC Controllable • Memory Pad • Normal/Reverse Satellite Functions • Optional 1200 MHz Band Unit • C